Osaamista
ja oivallusta
tulevaisuuden
tekemiseen

Ane Orue-Etxebarria

Degradation of plastics and polymer-based materials in museum collections

Case study: Inka Nieminen's transparent tape sculptures

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This thesis deals with the degradation of plastics and polymer-based materials in museum collections. This is illustrated in a case study which examines the degradation process of two modern sculptures by Finnish artist Inka Nieminen, built from cling film and transparent adhesive tape in 2004, and currently part of the Saastamoinen Foundation's collection stored at the Espoo Museum of Modern Art EMMA.

A general survey of plastics and plastic-containing objects in Finnish museums was conducted in order to provide a context to this thesis. The survey uncovered some of the challenges related to documenting such items. This was followed by a thorough documentation of both sculptures. A central role in this documentation process was played by the artist interview, in which the artist talked about her background, creative process, and views on aging and conservation of her artworks, as well as providing detailed information about the meaning and intended appearance of these sculptures.

It was suspected these sculptures may have deteriorated (yellowed) faster than expected, so part of this thesis deals with proving this theory and uncovering the reasons behind it. In order to do so, the sculptures were compared to others made by the same artist and using the same materials and techniques. Material analyses were also conducted and possible factors involved in the accelerated yellowing identified. The material used in these sculptures was revealed to be a melted mixture of Elmu®kelmu cling film (low-density polyethylene) and 3M Scotch® 550 Transparent tape (polypropylene film with an acrylic-based glue), and the packing choices and materials implemented in 2006 were singled out as unsuitable. The effects of the lack of ventilation and the presence of packing cardboard and moist paint were further proven to be responsible for the accelerated yellowing, through artificial aging tests on mockup samples.

In hopes of providing assistance with caring for collections comprising plastics and plastic-containing objects, a chapter dealing with guidelines for preventive conservation is provided in the end. In addition, a useful tool for the identification of plastics is provided. It can also be of use to museum professionals without prior expertise in the subject.

Keywords	conservation, plastic, degradation, tape, modern art, Inka Nieminen

Tekijä Otsikko Sivumäärä Aika	Ane Orue-Etxebarria Muovin ja polymeeripohjaisten materiaalien ikääntyminen museokokoelmissa. Tapaustutkimus: Inka Niemisen läpinäkyvät teippiteokset 60 sivua + 7 liitettä 20.5.2020
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Tässä opinnäytetyössä tutkitaan muovien ja muovia sisältävien esineiden vaurioitumista museokokoelmissa. Tämän selvittämisessä käytetään esimerkkinä kahta suomalaisen taiteilijan Inka Niemisen taideteosta. Nämä teokset on vuonna 2004 rakennettu Elmu®kelmu-kalvosta ja 3M Scotch® 550 Transparent -teipistä, ja ne kuuluvat nykyään Saastamoisen Säätiön kokoelmaan, joka on Espoon modernin taiteen museo EMMAssa deponoituna.

Työn viitekehykseksi kartoitettiin muovien ja muovia sisältävien esineiden nykytilannetta yleisellä tasolla. Kartoitus onnistui myös tuomaan esille haasteita, jotka liittyvät mainittujen esineiden dokumentointiin. Seuraavaksi teokset dokumentoitiin perusteellisesti. Dokumentointiprosessissa keskeinen oli taiteilijahaastattelu, minkä avulla kerättiin tietoa taiteilijan taustasta, luomisprosessista ja näkökulmista, sekä hänen teostensa vanhentumisesta ja konservoinnista. Samalla saatiin myös tietoa teosten merkityksestä ja tarkoitetusta ulkonäöstä.

Tutkittavien teosten epäiltiin vaurioituneen (kellastuneen) odotettua nopeammin, joten osa opinnäytetyöstä käsittelee tämän teorian todeksi osoittamista ja mahdollisten syiden paljastamista. Tätä varten veistoksia verrattiin muihin saman taiteilijan samalla tekniikalla ja vastaavilla materiaaleilla valmistettuihin teoksiin. Materiaalianalyyseja suoritettiin ja mahdolliset nopeutuneeseen kellastumiseen liittyneet tekijät tunnistettiin. Materiaali osoittautui Elmu®kelmu-kalvo- (LD-polyeteeni) ja 3M Scotch® 550 Transparent -teippiseokseksi (polypropeeni kalvo ja akryylipohjainen liima). Vuonna 2006 käytetyt pakkaustapa ja -materiaalit identifioitiin epäsopiviksi. Näytekappaleiden ikääntymistestien avulla todettiin ilmanvaihdon puutteen sekä hapollisen pakkauskartongin ja kostean maalin läsnäolon aiheuttaneen nopeutettua kellastumista.

Opinnäytetyön lopuksi on luku, joka käsittelee ennaltaehkäisevän konservoinnin ohjeistusta. Luku on tarkoitettu avuksi muovia sisältävien kokoelmien hoitoon. Lisäksi mukana on hyödyllinen työkalu muovilajien tunnistukseen museoammattilaisille. Työkalu soveltuu myös niille, joilla ei ole aiempaa osaamista muoveista.

Avainsanat	konservointi, muovi, vaurioituminen, teippi, nykytaide, Inka Nieminen

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I would also like to thank the Espoo Museum of Modern Art EMMA for allowing me to use two of the artworks housed in the museum as case studies for this thesis. My gratitude goes in particular to chief curator of collections Henna Paunu and assistant curator Aura Vilkuna for their help in this project and fellow conservators Katja Oijusluoma, Marianne Miettinen, Saara Peisa and Jenni Enbom for mentoring me, kindly sharing their knowledge and inspiring me to pursue the field of conservation of plastics.

Huge thanks also to the “plastics team” in Cologne/Oberhausen, Friederike Waentig, Lisa Burkart, Laura Bode and Uta Scholten for sharing their love for plastics and vast knowledge during a truly great internship!

And last but not least, all my gratitude to Inka Nieminen for the interview and allowing me to visit her atelier, Marianne Miettinen (again!) for the invaluable suggestions while writing this thesis and Lassi Patokorpi for the support and very needed proof-reading!

Table of contents

1 Introduction

The idea of writing my bachelor's thesis on plastics could not have been further from my thoughts when I enrolled as a student of Conservation of Historical Objects at the Metropolia University of Applied Sciences. As a lover of antique objects of all kinds, I would dream of someday working in a museum, surrounded by antiques and taking care of them. A stroke of luck brought me to conduct the first internship of my studies at the Espoo Museum of Modern Art EMMA, where I was given the exceptional opportunity to be part of a wide variety of projects and processes belonging to the sphere of responsibilities of the conservator in a museum context. This internship helped me develop and hone organizational, collaboration and decision-making skills in ways that I will always be thankful for, but it also made me realize what I most love about conservation. While working with aesthetically pleasing objects is certainly satisfying, I find it most gratifying when the objects I am working with are scientifically, structurally or conceptually challenging, which makes conservation of modern and contemporary art (and plastics!) especially suitable.

During my internship I had a first taste of what working with plastic objects is like, while conducting the condition checks and conservation of the objects featured in the *Futuromania* exhibition. This exhibition was organized in conjunction with the 50th anniversary of Finnish architect and designer Matti Suuronen's Futuro 001 house, which belongs to the collection of the Espoo City Museum, housed in the same building as EMMA. The challenging nature of plastics and plastic-containing materials began to pique my interest, which eventually lead me to conduct my second internship in the Cologne Institute of Conservation Sciences of the University of Applied Sciences of Cologne, under the guidance of Friederike Waentig and her team. This experience only reinforced my belief in wanting to learn more about plastics and how to conserve them, which finally lead to the subject for this thesis.

The conservators at EMMA kindly suggested a couple of plastic-containing artworks held in the museum, and I was instantly drawn towards the subjects of this study for the rarity of their materials (sculptures made of transparent tape!). It was clear from the beginning that these sculptures display signs of degradation that were most likely not reversible, which lead to the focus of this thesis shifting towards studying these signs of degradation and their causes. It was also suspected these sculptures may have degraded at a faster

rate than other similar sculptures by the same artist. The museum wished for a thorough documentation of these sculptures to be written.

Therefore, it was noted that an artist interview needed to be conducted in conjunction with the documentation process. This interview would turn out to be central in gathering information about not only these sculptures, but also the artist herself, her career, creative processes and thoughts regarding the aging and conservation of her artworks.

In order to set a context for this study, a quick survey of the current situation of plastic and plastic-containing items in Finnish museum collections will be conducted. Subsequently the sculptures of this thesis' case study, *Suonisto* and *Turkis*, will be studied and thoroughly documented, and their lifespan and degradation process compared to those of similar sculptures made by the same artist. In addition to this, the most common degradation processes of plastics and polymer-based materials will also be presented, and I shall attempt to identify the most likely factors contributing to these sculptures' degradation processes. These possible factors will be tested in the laboratory by conducting accelerated aging tests in mockup test samples. Finally, useful information and guidelines on preventive conservation of plastics will be presented, as well as a useful tool for identification of plastics.

It is my humble aspiration that this thesis will contribute to the effort of spreading the notion that plastics are ubiquitous in museum collections, and that their unstable nature makes them especially sensitive to degradation. This, in turn, substantiates why it is of such import to identify and monitor plastics and plastic-containing objects in museum collections, as well as provide them with suitable storage conditions.

2 Plastics and polymer-based materials in museums

2.1 Plastics and polymer-based materials

According to the online Cambridge Dictionary (PLASTIC | meaning in the Cambridge English Dictionary, n.d.) a plastic is "*an artificial substance that can be shaped when soft into many different forms and has many different uses*", and a polymer is "*a chemical substance consisting of large molecules made from many smaller and simpler molecules*" (POLYMER | meaning in the Cambridge English Dictionary, n.d.). The definition for polymers is relatively clear and accurate, but defining plastics is not as

straightforward, and it could be said the definition in the online Cambridge Dictionary is rather generic. In order to get a better understanding of these terms, we need to have a look at how plastics are built from a chemical point of view.

Brydson (1999, 19 – 20) tells us that a polymer is a large molecule built as a result of the repetition of many small linked units, usually creating long chains of 1000 – 10000 individual units or monomers. Many different polymers can be encountered in nature, such as proteins, cellulose and starch, but many more can be and are synthetically created. Plastics as we know them are a polymer-based material, but they usually also contain many other substances besides the polymers themselves. As the polymers are the main, so called "ingredient", the plastics are usually named after them (Shashoua 2008, 39 – 40).

One of the reasons why the word "plastic" causes confusion, is that it is used to describe both a property and a material, and the plastics as materials do not necessarily always have a plastic property. As a property or adjective, the online Cambridge Dictionary defines plastic as "*soft enough to be changed into a new shape*" (PLASTIC | meaning in the Cambridge English Dictionary, n.d.), and gives us two interesting example sentences:

> Clay is a very plastic material.
>
> This metal is plastic at high temperatures.

These examples are especially interesting, because in both cases the word "plastic" is used to describe a material that is definitely not what we understand as a "plastic", but it is true that both clay and metal can display plastic properties.

Polymer-based materials that display plastic behavior do so because, above a certain temperature called the Glass Transition Temperature (Waentig 2008, 332), the polymer strands they are composed of can freely move in space, and the material can thus take a new shape. These materials are called *thermoplastics*. On the other hand, there are polymer-based materials that can undergo chemical reactions creating cross-linking between the different polymer chains they are composed of. These materials are called *thermosetting* materials. (Brydson 1999.) Due to this cross-linking, these materials stay rigid even if the temperature rises (up to their decomposing temperatures), so they do not possess plastic properties (Waentig 2008, 336 – 337). In addition to thermosetting

and thermoplastic plastics a third category is often mentioned, *elastomers*. While elastomers can in turn also be thermoplastic or thermosetting (Jansen 2016), their main attribute is that they can be stretched to more than twice their size and regain their original shape when the external force is withdrawn (Waentig 2008, 15 & 330).

Many of the properties plastics have depend on the polymers they are made of. Some plastics are composed of a single kind of monomer, but some others are *copolymers*, which means the strands of polymers they are made of are, in turn, composed of more than one kind of monomer (Shashoua 2008, 44). Additionally, a plastic can also be composed of a mixture of polymers, known as *polyblend* or polymer blend (Brydson 1999, 55 – 56).

Besides polymers, plastics often contain a number of additives. These additives are added in order to facilitate the production process or modify the polymer resin's physical and/or chemical properties. Many of these additives provide properties as useful as an increase in mechanical strength, change of appearance, UV-resistance, protection against fire and added flexibility. Some of the most widely used additives include fillers, colorants, plasticizers and flame retardants. (Brydson 1999, 124; Murphy 2001, 1 – 3.) Unluckily enough, in addition to sometimes presenting serious health and environmental risks (Murphy 2001, 257 – 267; Kutz 2013, 265) these additives can also be the cause of the degradation of plastics when they evaporate or start migrating to the surface (Shashoua 2008, 159 – 160).

2.2 Plastics in museum collections

Before proceeding with the case study at hand, an overview of the situation of plastic-containing objects in Finnish museum collections will be presented.

2.2.1 Background

It is still a common belief that most museum collections do not include plastics, but this is far from the truth. In fact, even museums holding historical collections are not exempt from them. Natural plastic materials such as natural rubber have probably been used for thousands of years (Waentig 2008, 24), and the process that produced the first so-called synthetic plastic, vulcanized rubber, was discovered as early as 1839 (Waentig 2008, 174 – 175). After 1839, more semi-synthetic plastics were developed, including cellulose

nitrate, celluloid (plasticized cellulose nitrate), casein formaldehyde and cellulose acetate, which were derived from natural materials such as cellulose and milk proteins (casein), and mostly used to imitate expensive materials such as tortoiseshell and ivory. In 1907 Leo Hendrik Baekeland succeeded in synthesizing the first fully synthetic plastic, phenol-formaldehyde, widely known as Bakelite (Waentig 2008, 229). In the following years, and leading up to the 1950s, deeper understanding and development of polymer chemistry brought about the discovery of many other fully synthetic plastics, such as PVC (poly (vinyl chloride)), urea-formaldehyde, PMMA (poly (methyl methacrylate)), polystyrene, polyamide (from which nylon fibers are made), melamine-formaldehyde, polyethylene, unsaturated polyesters, silicones, polyurethanes and epoxy resins (Waentig 2008, 33 – 36). As the production of these new materials became cheaper, they reached the markets and were used for all kinds of applications, from kitchenware, furniture and clothing, to medical equipment, all kinds of machinery, and even housing. After the 1950s, the chemical industry started to experiment with creating new materials with specific properties, and plastics started to replace an increasing amount of traditional materials, due to desirable properties such as light weight and fire resistance. (Waentig 2008, 33 – 55; Shashoua 2008, 19 – 36; Brydson 1999, 33 – 55 & 11 – 14.)

As a result of the long history of development and production of plastics and plastic objects, most of the museums do house plastic objects (Shashoua 2008, 7), albeit they are often overlooked (Shashoua 2008, 8) or confused with the materials they were intended to imitate, such as ivory and tortoiseshell. A wide variety of everyday objects have been partly or entirely produced from plastics and have already entered museum collections as valuable witnesses to the development of technology, economy and design (Shashoua 2008, ix). On the other hand, artists often jump at the possibility of using new and exciting materials. Even nowadays, plastics are such a versatile and (usually) cheap material, that it is readily used by artists in their sculptures and installations (Beerkens 2001, 7 – 8).

While most museum collections contain plastics, some of them may contain a higher proportion, depending on what kind of objects their collections focus on. For example, a photography museum is likely to house a high amount of cellulose nitrate films, while a toy museum may contain all kinds of colourful plastics, and an archeological museum may contain very few to none. Their numbers are nevertheless likely to increase in time, since plastic is still produced in great quantities, and many of these newer objects will eventually find their way into museum collections.

2.2.2 Plastics in Finnish museum collections

In order to analyze the current volume of plastic-containing objects in Finnish museums, a survey was conducted among a number of the museums in the Greater Helsinki area. The museum representatives were asked how many objects belong to their museum's collections, and how many of them contain plastics. Most of the results are of searches conducted within the museums' online Collections Management Systems (CMS). The data was collected through email exchange with representatives of the museums contacted (Derichs 2020; Langinauer 2020; Vihunen 2020; Vilkuna 2020; Eskola 2020; Lahti 2020; Brander 2020; Rassi 2020; Laatikainen 2020; Kallio 2020; Tegelberg 2020; Kiiskinen 2020; Immonen 2020; Nurminen 2020; Rantasalo 2020; Ojala 2020; Westergård 2020; Juvonen-Eskola 2020). The results are charted below (Table 1.).

Table 1. Number of plastic-containing objects in museums of the Greater Helsinki area. The total amount of objects (when available) is given inside parentheses, and estimations are highlighted in red.

Museum	**Objects in the CMS (total)**	**Objects containing plastic in the CMS (estimated total)**	**Percentage**	**Observations**
Amos Rex	6 144	10	0,16%	According to the conservator the information is not reliable, materials have not been described properly
Artsi Vantaa	10 000 (10 000)	5 (5)	0,05%	Material information has not been documented systematically, and the total amount is probably higher
Design Museum Helsinki	75 000	800	1,07%	
EMMA	10 479	424	4,07%	Installations with many parts are counted as many objects
Espoo City Museum	47 000 (50 000)	2 900 (3 085)	6,17% (est. 10%)	Many catalogued items are missing material information
Finnish Museum of Photography	540 000 (2 000 000)	181 000 (660 000)	33% (est. about 50% for objects)	Huge collection (specially pictures and negatives), so only a small part is systematically catalogued
Finnish Museum of Theatre	7 285 (29 100)	825 (3 295)	11,32%	Only about a quarter of the collection is catalogued
Finnish Toy Museum	700 (15 000)	140 (3 000)	20%	Under 5% of the collection is catalogued, and the percentage of objects containing plastic is probably higher than 20%
HAM	9 800	400	4,08%	Materials are not documented systematically
Helsinki City Museum	70 008 objects 28 981 archive materials (453 618)	5 829 399	8,33% objects 1,38% archive materials	This data corresponds to objects from the historical object collection. Material information is not available for all catalogued objects.
Helsinki University Museum	31 000 (46 000)	1 400 (2 077)	4,52%	About a third of the collection is not catalogued

Hotel and Restaurant Museum	5 000 (6 000)	Under 200 (1 000)	4% (est. 16,7%)	Many objects catalogued under the same inv. number, total amount of objects actually closer to 10 000
Kansallismuseo	337 280 (530 000)	9 687 (15 222)	2,87%	About a third of the collection is not catalogued, but they do include material information of, for example, buttons belonging to clothing
KIASMA	8 000	800 – 1 000	10 – 12,5%	Estimation
Museum of Finnish Architecture	650 (only scale models)	?	?	Their collection management system does not allow to search for plastic as a material
Museum of Technology	(20 000)	(4 000 – 6 000)	20 – 30%	Information about materials is not systematically catalogued
Sinebrychoff Art Museum	?	0	0%	The collection contains items from around 1300 – 1850
Vantaa City Museum	10 035 (25 478)	1 730 (4 392)	17,23%	Less than half of the collection is catalogued. Not all catalogued items have material information available

This survey clearly illustrates some of the challenges of the task. To begin with, many museums still lack the resources to fully catalogue their collections. On the other hand, this leads to the cataloguing process sometimes being done hastily or unsystematically, leading to lack of information (in this case, information about the materials). On average, an estimated 5% of the collection objects in most of the museums surveyed contained plastics, with some collections containing as much as 20 – 30%. According to most of the people interviewed, the percentage of items containing plastics in their collection is probably higher than that estimated through searches in their Collection Management System. These are nevertheless huge numbers, and if we keep in mind that most plastics in museum collections start showing visible signs of deterioration within 5 – 35 years (Shashoua 2008, ix) the magnitude of the problem really begins to unfold. In her book, Shashoua (2008, 8) mentions the ‘plastics denial syndrome’, which is a term a polymer scientist at the V&A Museum in London is said to have come up with, as the reason why many of her colleagues fail to document plastics in their collections. On the positive side, it was also observed how some museums have started to catalogue material information of small components of bigger objects, such as buttons in a piece of clothing (Immonen 2020).

Even though in many cases lack of time and/or resources may be the main reason, most people handling the collections may also lack the expertise to identify different plastics. In the final chapter of this thesis, a useful tool for identification will be presented that may be especially useful to museum professionals.

In addition to plastics often being overlooked during the cataloguing process, they are very seldomly sorted in a systematic and coherent way. Most often the type of plastic is not listed, and if it is, it is done so by using a commercial name or a common name (instead of the chemical name of the compound). This may lead to confusion and difficulties when trying to figure out how many objects of a certain plastic there may be in a collection. In order to illustrate this point, a series of searches was conducted in Finna.fi (finna.fi, n. d.), which is a search engine comprising Finnish archive, library and museum materials. In order to limit the search results to those of museum objects, only the following categories were analyzed: photographs, objects, sculptures, industrial design, art objects, installations, textile art and media art. It is likely some of the possible search terms for plastic types have been missed in this study, but it still gives an accurate idea of the current situation. The full chart including all search terms and results can be found in the appendices (Appendix 4., Table 1.).

It may be observed that the problems mentioned do occur and are still commonplace nowadays. Of a total of 29 397 objects catalogued as containing plastic, less than half include information about the kind of plastic. It can also be noted that, when the type of plastic is mentioned, common names or brand names of plastics are often used instead of the names of the chemical compounds. As a result, searches including 3 – 5 different terms are often needed in order to locate all objects containing a certain kind of plastic. For example, in order to find all objects containing cellulose nitrate, the search terms needed would be (at least) selluloosanitraatti, nitroselluloosa, xylonite, celluloid and selluloidi. In addition to that, most of the cellulose nitrate negatives have been described as nitraatti (nitrate), which is the name of an inorganic chemical compound that can return many false matches. These objects had to be searched for by using both nitraatti and negatiivi (negative) as search terms, in order to avoid false positives. Poly(methyl methacrylate) (PMMA) is a similarly challenging case, since one of the most common names used to refer to it is akryyli (acrylic), which is an umbrella term for many different chemical compounds that include the acrylate group. For example, acrylic paints and lacquers are very widely used in art and, as a result, searching for akryyli returns a huge amount of objects that do not contain PMMA.

Besides looking at the different terms used for different plastics, the distribution of the kinds of plastic-containing objects was also studied. In order to do this, all search terms included in the previous study (Appendix 4., Table 1.) were used, with and without the term muovi (plastic). This way, an approximate amount of plastic-containing objects was

estimated, for objects that include information about the type of plastic vs. objects that do not. It is nevertheless worth mentioning that the real amounts are much higher, since material information of objects with small parts made of plastic is often lacking. The results can be found below (Table 2.).

Table 2. Table 2. Search results for plastic-containing objects in Finna.fi (finna.fi, n. d.).

Type of plastic-containing object	**Total amount catalogued**	**Total amount catalogued, containing information on type of plastic**
Object	29 397	13 009
Negative	17 261	15 841
Sculpture	60	41
Painting	27	21
Art object	33	14
Installation	20	13
Media art	6	4
Textile art	1	1

It may be noticed that only about half of the plastic-containing objects catalogued incorporate information about the type of plastic. In the case of negatives, it is actually the opposite. Most of them have been listed by the type of plastic they are made of (15 841), and only 1 692 of them included the word muovi (plastic). This may be due to the fact that cellulose nitrate and cellulose acetate (common materials in old negatives) are especially delicate materials that degrade very easily. During the degradation process they produce nitric (CN) and acetic (CA) acid gases, which in turn accelerate the degradation further, and can be dangerous to other nearby objects (Shashoua 2008, 177 – 184).

Finally, a study of the distribution of the different types of plastic within this sample group was conducted. The distribution was studied separately for all plastic types included in our sample group, for objects (objects and negatives), artworks, and all combined. Both the number of objects and the percentages were calculated. The results can be found in the appendices (Appendix 4., Table 2.), but in order to present the results in a more intuitive way three pie charts were drawn (Charts 1 – 3.). Since the percentage of some kinds of plastics is very low, some of them have been grouped together and their combined percentages have been displayed instead.

Chart 1. Distribution of plastic-containing objects (objects, negatives and artworks) in Finna.fi by plastic type (finna.fi n. d.).

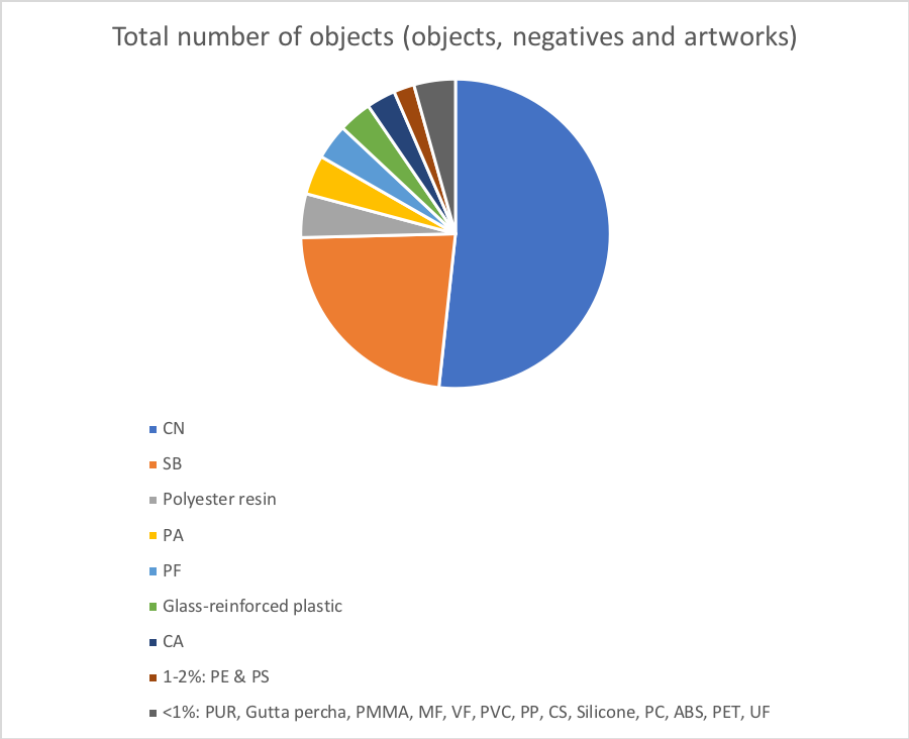


Chart 2. Distribution of plastic-containing objects (objects and negatives) in Finna.fi by plastic type (finna.fi n. d.).

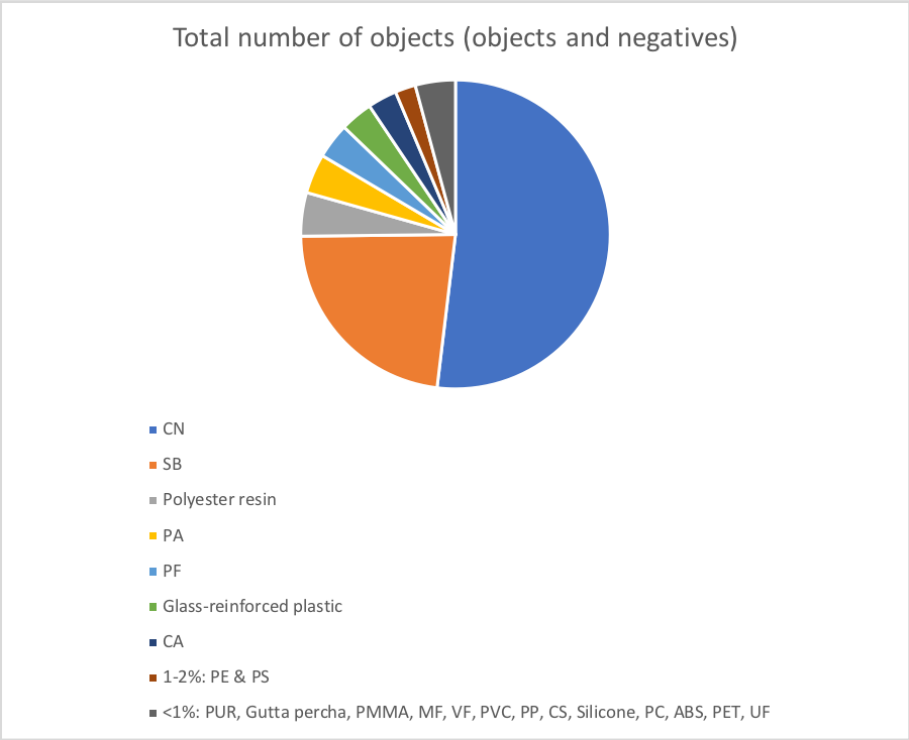
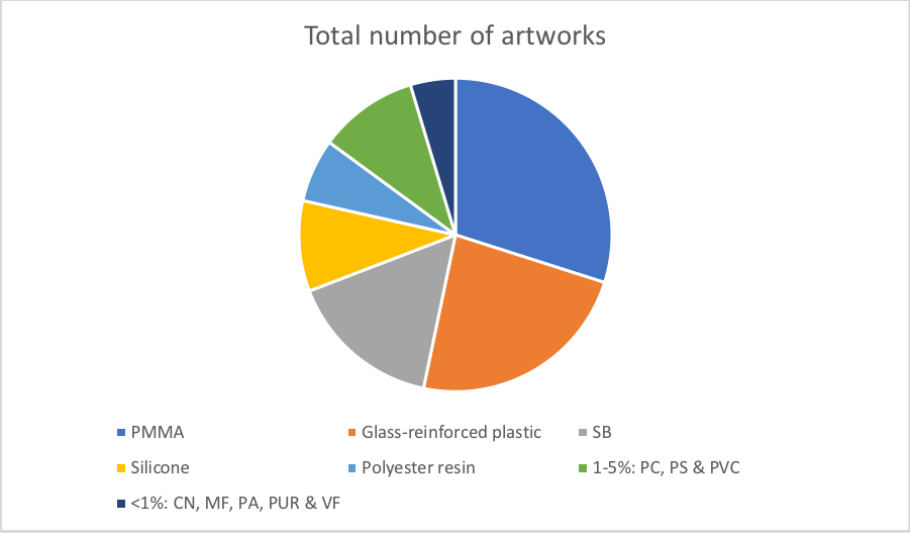


Chart 3. Distribution of plastic-containing artworks in Finna.fi by plastic type (finna.fi n. d.).



It can be noticed that the number of objects (objects and negatives) is such that the combined chart of objects and artworks is very similar to that of only objects. This is probably due to the fact that almost three quarters of the plastic-containing objects catalogued, that include information about the type of plastic, are made of either cellulose nitrate or rubber. Rubber, as is the case with cellulose nitrate, is also an especially unstable material. It readily reacts with oxygen, and in order to preserve rubber collections (such as Nokia's rubber boot and tire collection in Museums' Collection Centre in Tampere), objects are kept in special storage facilities under cool and oxygen-free conditions (Koskinen, 2014). It is therefore possible that the material information of rubber objects has been catalogued with special care, just as it has been done with negatives.

3 Inka Nieminen's transparent plastic tape sculptures

3.1 Background

Most of the information in this section, as well as section 3.2, was obtained by conducting an artist interview (Appendix 1.). The structure of the interview was designed following the guidelines included in "Concept Scenario – Artists' Interviews" (1999), developed by the Netherlands Institute for Cultural Heritage/Foundation for the Conservation of Modern Art.

3.1.1 Inka Nieminen

Inka Nieminen, born 1971, is a Finnish artist and sculptor from Hailuoto in Northern Finland. She pursued her art studies in different art schools finally arriving at the Academy of Fine Arts in Helsinki in 1993. She has been drawn towards nature and properties of different materials from the very beginning, but due to the fact that teaching in her time was mostly focused on drawing and painting, she only begun to really focus on sculpture about halfway through her studies at the Academy of Fine Arts. In the 1990s basic materials were still predominantly used for sculpting. This included wood, metals, plaster and ceramic. According to Nieminen, usage of other materials, such a plastic, was seen as odd, and not encouraged. She started to find her own approach to sculpting through ceramic and felt that the introduction of installations made creative work easier. At the moment she acts as a lecturer in both The Academy of Fine Arts in Helsinki and the Aalto University, in which she teaches courses dealing with, among others, materials. (inkanieminen.com 2019; Nieminen 2020.)

She has a “hands on” approach to her creative process and prefers letting the materials guide her hands. She finds inspiration primarily in nature and the dichotomy between natural and artificial, and therefore has plenty of artworks studying the subject. She favors techniques that do not require overly complicated processes, as she prefers to make as much as possible herself, and to use easily sourced materials. She is nevertheless also open to new techniques and technologies. Her work as a lecturer at Aalto University has made it easier for her to try new ideas, mostly because of easy access to the science and engineering specialists in said university. Materials are very important to her, not only individually, but especially used in combination with each other. By using artificial or synthetic components, she seeks to enhance the nature of natural materials, such as wood or wool. (Nieminen 2020).

3.1.2 History and meaning behind Nieminen’s plastic tape sculptures

Nieminen came up with the idea of creating sculptures out of tape during a residency in Ireland, in 1999. At the end of it, students were expected to create some works for a final exhibition. The artist had originally applied for the residency in Ireland intending to work with metals but, in the end, she did not find it sufficiently interesting. She briefly considered working with wood, which is a material she was familiar and comfortable with, but it was hard to obtain in the country. After having some difficulties trying to find a

material that would be easy enough to source and interesting to work with, she bought some tape and some other plastic items from a shop and started developing her technique. She got her sculptures ready the day before the opening and gathered very positive feedback from her tutors. She continued creating sculptures out of tape when she returned to Finland, until around 2004, when she felt that she had concluded researching the subject. (Nieminen, 2020.)

She was drawn to working with plastics due to the many possibilities they offer. They can be soft or hard, can be molded and melted with heat, can be transparent, and are easy and cheap to get. Another feature that makes plastics interesting to Nieminen is their lightness and feeling of transparency, which is especially important in the case of her tape sculptures, as she wanted to create an illusion of weightlessness and incorporeality. The sculptures take the form of hollow and life-sized human shapes, and are intended to both be sheer and also reflect some light on their surface. (Nieminen 2020.)

3.1.3 Materials and technique

Information about the materials and technique was also gathered in the interview conducted at the artist's residency in Helsinki (Appendix 1.), but detailed information about the technique will not be fully disclosed in this thesis, as the artist prefers it to not be made publicly available. Nevertheless, it will be included in the artist interview that will be stored in EMMA's collection management system. Some information about the materials involved in the production of these sculptures will nevertheless be disclosed with the artist's permission. (Nieminen 2020.)

Nieminen's tape sculptures are mostly made of 3M Scotch® 550 Transparent tape, on a base of Elmu®kelmu transparent cling film and melted together into a hard shell, sometimes unevenly. There is some variation among different statues, but wider areas are often reinforced with metallic wire, and polymethylmethacrylate tubes added to the feet's soles. They may also contain other kinds of tapes on their surface (to create details), paint (Miranol), and/or boat lacquer (most likely Hempel). Scotch®'s transparent tape was especially chosen by the artist due to it being the most transparent, both before and after melting. The coloured tapes were chosen because of their interesting shades and easy availability. (Nieminen 2020.)

3.1.4 Degradation

The outcome of Nieminen's technique is a complex mixture of different plastics and polymers. Thus researching its degradation processes is one of the aims of this thesis. However, in order to delimit the scope of this study only the visible symptoms of degradation will be addressed here.

There are two main symptoms of degradation found in these sculptures, the first is linked to the production technique and the second to the materials themselves. The first symptom was mentioned by the artist during the interview (Appendix 1.) and is due to the stress applied on the tape during the production of these sculptures. According to the artist the surface of the sculptures is intended to be tight and smooth, for which the artist applies stress to the material during the application of the tape. Unluckily enough she has noticed that the surface tension deforms the smooth finish in a matter of weeks. She has tested different methods in order to fight this type of degradation, without clear success. The other, more visible sign of degradation, is the yellowing of the material. This yellowing begins to slowly appear within a few years after the production of the sculptures and gradually turns the transparent areas a rich warm shade of yellow. (Nieminen 2020.)

3.2 *Haute Couture* series

3.2.1 History of the series

The *Haute Couture* series (Figure 1.) was created in 2004 (inkanieminen.com 2019) and, according to the artist, it is the last of her transparent tape sculptures. The series is a collection of three figures: *Suonisto*, *Turkis* and *Puunsyy*, that can be translated as "Veins", "Pelt" and "Wood grain". This series was created for the Mänttä Art Festival (Mäntän Kuvataideviikot) in 2004, which run from 6.6.2004 to 15.8.2004 (Helsingin Sanomat 2004). As a whole, the series is intended to depict a passing moment in time, which is presented as a fashion show. The figures portray mannequins and are intended to be impersonal, representing humans in a general sense. *Suonisto* displays a network of veins on its surface, made from thinly sliced red tape, and is intended to represent the inner path humans go through. *Turkis* is covered in thinly sliced brown packing tape that depicts fur and researches the animal within each of us. *Puunsyy* is decorated by thinly sliced brown packing tape, creating a pattern similar to that in wood grain and, in a similar

manner to *Turkis*, it also explores the relationship between humankind and nature. (Nieminen 2020.)

Figure 1. "Haute Couture" at Mänttä Art Festival 2004. From left to right: Suonisto, Turkis and Puunsyy. Picture: www.inkanieminen.com / Inka Nieminen.

In 2006 two figures from the series *Haute Couture* were purchased in by the Saastamoinen Foundation, which deposited their collection at EMMA – Espoo Museum of Modern Art. The sculptures *Suonisto* (SSKO:1971 Suonisto 2006) and *Turkis* (SSKO:1972 Turkis 2006) and have been kept in storage after the purchase (Vilkuna 2020a).

3.2.2 Documentation and condition assessment

Suonisto and *Turkis* were documented by object conservator Raili Laakso in 2006. Laakso also took digital pictures (Figures 2 & 3.) and both planned and executed the storage boxes for the sculptures (SSKO:1971 Suonisto 2006; SSKO:1972 Turkis 2006). These boxes were most likely opened just once, in 2009, when EMMA's photographer Ari Karttunen photographed the works (Figures 4 & 5:) (Vilkuna 2020a). The sculptures have otherwise been kept in the storage, inside their boxes.

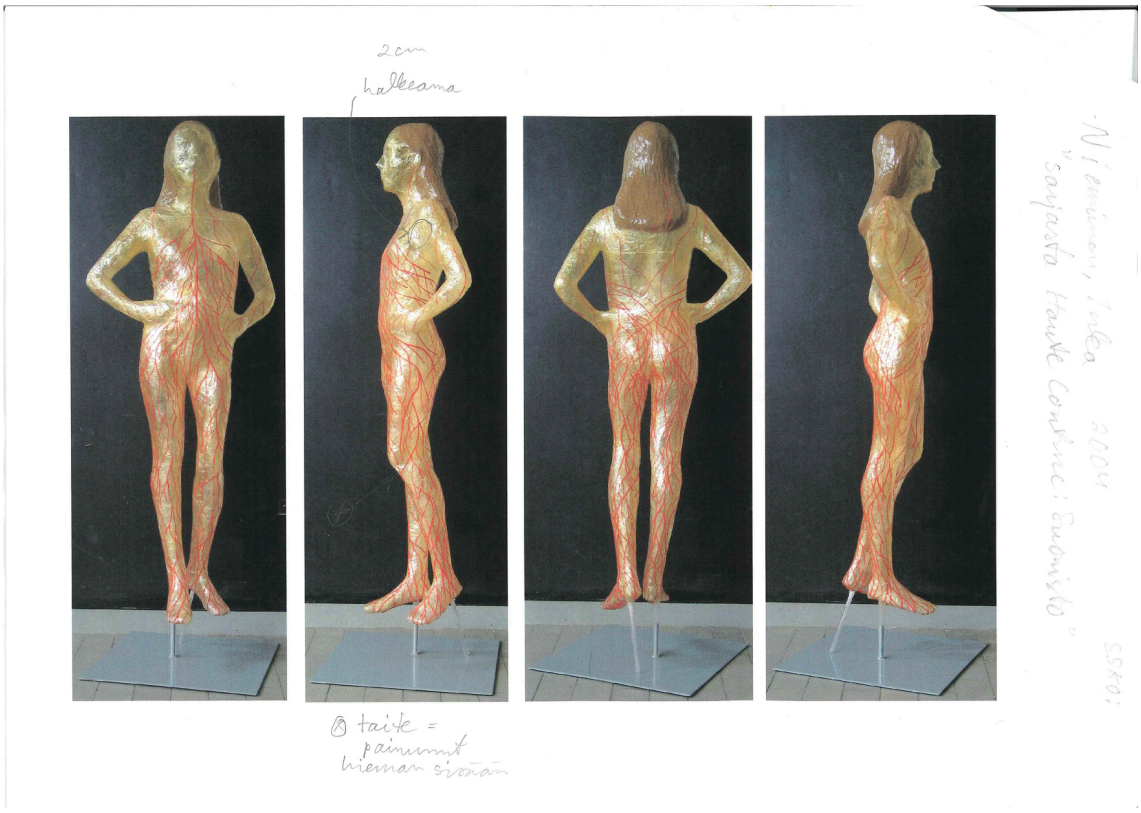


Figure 2: Documentation pictures of Suonisto upon purchase, in 2006. Pictures: EMMA / Raili Laakso.

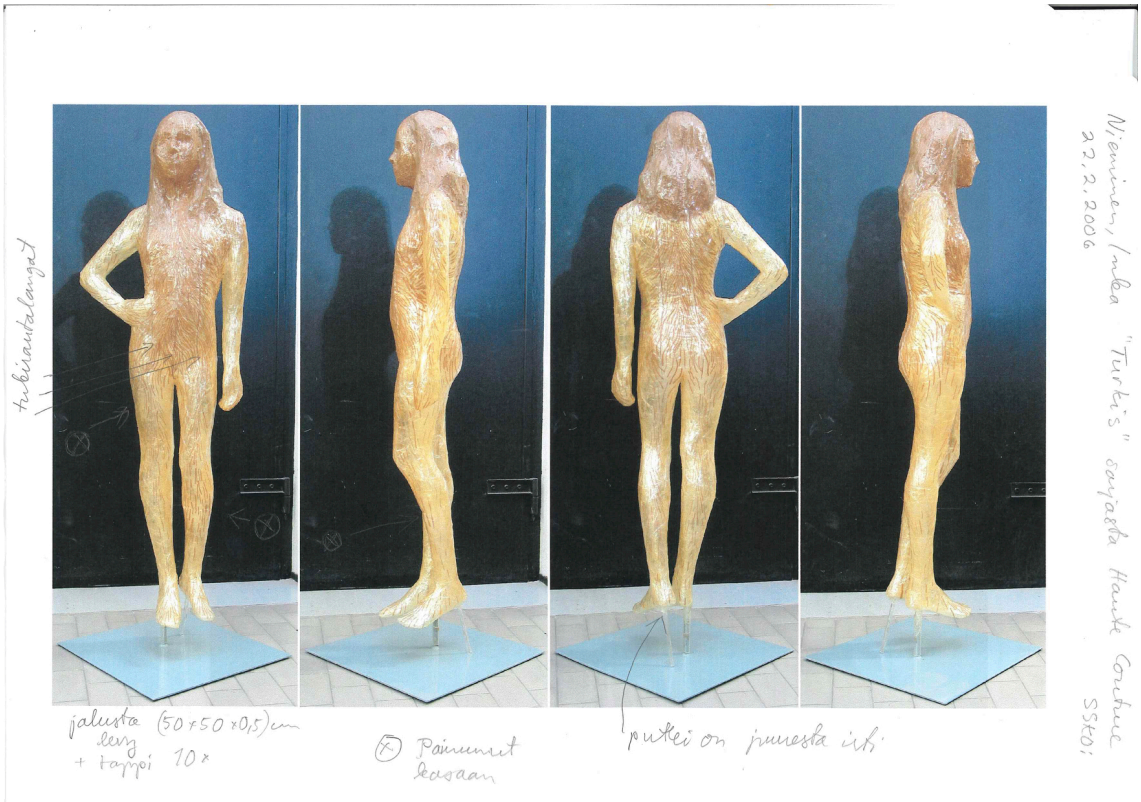


Figure 3. Documentation pictures of Turkis upon purchase, in 2006. Pictures: EMMA / Raili Laakso.

Figure 4. Catalogue photograph of Suonisto, in 2009. EMMA / Ari Karttunen.

Figure 5. Catalogue photograph of Turkis, in 2009. EMMA / Ari Karttunen

The Espoo Museum of Modern Art – EMMA was opened in October 2006 and the conservation premises were still not ready at the time (Miettinen 2020). Due to lack of time and resources during this period, the documentation could not be conducted with sufficient attention to detail. Therefore, one of the requests made by EMMA with regard to this bachelor's thesis was a comprehensive documentation and condition report of both objects. Documentation pictures were taken in 4.11.2019 (Figures 6 & 7.), and the sculptures documented throughout a period of a couple of weeks. The documentation files can be found as attachments (Appendices 2 & 3.). They are written in Finnish as the documents are intended for internal use of the museum.

Figure 6. Documentation picture of Suonisto in 2019.

Figure 7. Documentation picture of Turkis in 2019.

Both sculptures seem to be in relatively good structural condition (no meaningful changes were noticed since 2006 when Laakso wrote his reports) but they have yellowed considerably (compared to Figures 1 – 3.). On the other hand, it seems they had already reached a similar degree of yellowing by the year 2009 (Figures 4 – 5.) when they were photographed by Karttunen.

Upon closer inspection of the yellowing it can be noticed that it is not as uniform as it may seem at first glance. In many areas the colour seems to be more or less uniform (Figure 8., cheeks) but in some places clear areas can still be observed (Figure 8., collarbone/shoulder). In parts where the tape is not melted enough, it can even be noted that the yellowing seems not to affect the plastic film of the tape itself but appears as a dark yellow fluid trapped between the tape layers (Figure 9.). It is likely this fluid is the degraded glue of the tape that has since yellowed. This possibility will be further analyzed in chapter 4.

Figure 8. Suonisto, face and shoulder detail.

Figure 9. Suonisto, left foot detail.

3.2.3 Lifespan analysis background

The Museum 2015 Project provides the definition of two different kinds of lifespans: the *physical life-span* [sic] and the *cultural life-span* [sic]. The first is defined as “The duration of an object as a physical entity from its manufacturing to its destruction.”, while the second is defined as “The duration of an object as a cultural entity. In the various stages of the cultural life-span [sic] the object appears as an idea, ready but unused, as object with a history of use and finally as a destroyed but documented or remembered object.” (Ekosaari, Jantunen and Paaskoski 2014.)

It may be noticed that while the first concept seems to be rather straightforward, the second one can be fairly difficult to determine, and spans far beyond what is defined as physical lifespan. Nevertheless, neither of these lifespans necessarily determine the actual “exhibition lifespan” of an artwork (or a museum object for that matter). Objects may be in such a condition that they may not be exhibited anymore (due to degradation and aging), but still far from the end of their physical lifespans. In addition to that, the development of new art forms (for example kinetic art, conceptual art and performance art) has added a whole new level of complexity to the matter (Marçal 2019.)

One of the main aims of conservation is to prolong the lifespan of cultural heritage objects and artworks. The so called “traditional conservation” has historically focused mostly on the physical lifespan, aiming to preserve of the original materials of the objects. Nowadays it is understood that cultural heritage comprises both material and immaterial aspects, and the focus of conservation has shifted towards preserving both. By implementing preventive and/or active conservation measures, conservators have a huge role in the changes an object goes through during its lifespan. In order to guide their decision-making, conservators follow a set of ethics such as the principles of reversibility and minimum intervention. Also linked to this are the concepts of integrity and authenticity and, in the case of artworks, the artist’s intention. Taking all these into account aids conservators reach a better understanding of the nature of the object at hand (Marçal 2019; van Saaze 2013, 39 – 47.)

Integrity and authenticity are linked to each other, and just as hard to define. What seems nevertheless clear is that there are many aspects to both of these terms, and all of them may have a part in the decision-making process of the conservator. The conservator will, in turn, have an effect in the lifespan of the object or artwork. Van Saaze mentions four

aspects of authenticity, originally presented by Dutch art historian Nicole Ex: faithfulness to material authenticity, faithfulness to conceptual authenticity (according to the artist's intention), faithfulness to contextual and functional authenticity and faithfulness to historical authenticity (the history of the object is made visible or left visible) (Nicole Ex 1993, cited in van Saaze 2013, 50 – 51). In some cases, these definitions of authenticity can come into conflict with each other and force the conservator to reach ethical compromises. An example of these is the replacement or substitution of parts or the totality of an artwork in order to preserve its function, which is nowadays an accepted conservation measure in modern and contemporary art. (van Saaze 2013, 36 – 59.)

The intention of the artist was also mentioned as a tool to facilitate the decision-making in conservation of artworks. In conservation of modern and contemporary art a clear advantage is that, in many cases, the artist is alive and can be consulted. It is nowadays common practice to conduct artist interviews when artworks are acquired by museums, and artists are often also consulted by conservators during decision-making processes. (van Saaze, 52 – 55.)

Finally, the point of view of the museum or owner of the artwork about when a specific artwork should not be displayed anymore should also be taken into account, as it may differ from that of the artist. Chief curator of collections at the Espoo Museum of Modern Art EMMA, Henna Paunu, was asked to give her opinion on the matter (Paunu 2020):

> It would be nice of the artist to introduce matters regarding the lifespan of the artwork during the acquisition process. The museum also weighs questions related to the lifespan while surveying possible acquisitions, but this is a newer practice, that was still not in place when Nieminen's sculptures were purchased. Museums develop constantly in matters regarding the acquisition processes of modern and contemporary art.
>
> I think that the artists often yearn for interaction and sparring with questions such as the naming of, the lifespan and the conceptuality of artworks. In my opinion the museum and collection specialists should not blindly comply with everything the artist says. Additions to the collections should always be carefully reviewed together with the artist. The reason for this is that the museum is the "user" of the artwork, as well as its guardian and conveyor of its content. This role can sometimes be shorter but may also span through generations. The point of view of the museum may also be introduced to the artist, suggestions presented and the wishes of the museum regarding that specific artwork explained. Background information about the artwork can of course also be completed at a later time by being in touch with the artist, if all relevant information was not gathered during the acquisition process, and if the artist is still alive.
>
> Personally, and as a curator, I think that the artists often wish interaction and cooperation when these matters are being assessed. Of course, it is possible some

> artists will not accept the opinions of others, but it is truly rare, and for many artists collaborating with the museum may help develop their ideas regarding the artwork further. In my opinion, if the artist has chosen a certain material that changes in time, they have in a way also accepted those changes and the risks attached. From the perspective of the museum and the audience these changes may also be interesting, and changes are quite common in materials used in modern and contemporary art. I would also think that these changes, while often uncontrollable, are also part of the artwork. Of course, it is important to listen to the artist. If the artist does not agree to their work being displayed due to changes in appearance, this is taken into account. This is why these possible scenarios of future changes should already be reviewed during the acquisition process and, if necessary, the artist should be sparred into considering the nature of these changes to be a part of the artwork. Clear criteria regarding the end of the artwork's lifespan should also be set at this point, in collaboration with the artist.

Due to the complexity of the matter, trying to analyze the actual cultural or exhibition lifespans of the artworks studied in this thesis would be too complex a task. Instead, I shall focus on trying to determine the period of these artworks' lifespan in which their appearance was able to successfully transmit the vision that the artist had in mind when she created them. In order to distinguish it from the physical and cultural lifespans, I shall call this period the *ideal state lifespan*.

These artworks have only been photographed at the exhibition they were created for in 2004 (Nieminen 2020), upon purchase when they were documented in 2006 (SSKO:1971 Suonisto 2006; SSKO:1972 Turkis 2006), and when EMMA's photographer took their portrayal pictures in 2009 (Vilkuna 2020a). After that, they have been inside their boxes in EMMA's storage until November 2019, when the boxes were opened in order to have them documented for this research. Due to this, reference sculptures needed to be used in order to gain more insight on the rate of degradation.

3.2.4 Reference sculptures: *Puunsyy* and *Läpinäkyvä tarjoilija*

An obvious reference candidate may have been the third figure belonging to the *Haute Couture* series, *Puunsyy*, which is still in possession of the artist (Figure 10.). According to Nieminen (2020) it has been hanging from the wall of her atelier, wrapped in paper and plastic bubble wrap for 15 years. During this time it has been exposed to direct sunlight, and a temperature of up to 45 °C in the hottest summer days. Upon inspection of said piece, we can see that it shows a similar degree of yellowing as *Suonisto* and *Turkis*, with areas yellowed heterogeneously and dark yellow fluid trapped between layers of tape (Figure 11.). Unluckily enough it cannot be used as a reference due to there being no records of its aging and deterioration in time. Nevertheless, when shown

pictures of *Suonisto* and *Turkis* taken by EMMA's photographer in 2009, Nieminen (2020) thinks it did not yellow as quickly.

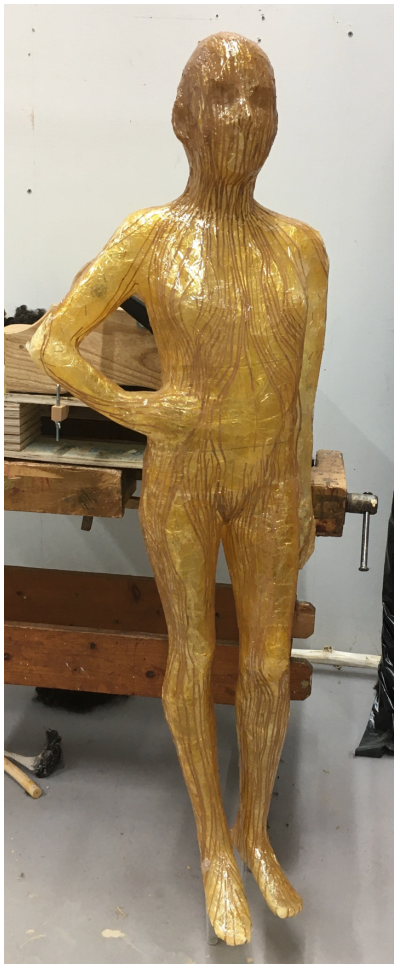


Figure 10. Puunsyy, 2020.

Figure 11. Puunsyy, left shoulder detail.

By a stroke of luck, another work by the same artist was found, created using the same technique and similar materials, and also owned by the Saastamoinen Foundation. This piece from 2003, called *Läpinäkyvä tarjoilija* (Transparent Waitress), was on permanent display at EMMA's permanent exhibition from 2006 till 2015, and pictures of it were taken at regular intervals in 2006 (Figure 12.), 2008 (Figure 13.), 2012 (Figure 14.) and 2015 (Figure 15.) (Vilkuna 2020a). Even though most of the sculpture is covered with other tapes, the transparent tape can still be seen in the face and arms, where the yellowing may be observed. Of course, these pictures were taken in different conditions and results of a quantitative analysis would not be trustworthy enough, but it is still possible to form a qualitative idea of the progression of its yellowing in time. This progression may be used as a baseline for the natural degradation and yellowing of Nieminen's tape sculptures on display in a museum environment.

Figure 12. Läpinäkyvä tarjoilija in 2006. Picture: EMMA / Katja Honkanen

Figure 13. Läpinäkyvä tarjoilija in 2008. Picture: EMMA / Ari Karttunen

Figure 14. Läpinäkyvä tarjoilija in 2012. Picture: EMMA / Ari Karttunen

Figure 15. Läpinäkyvä tarjoilija in 2015. Picture: EMMA / Marianne Miettinen

By using the white stand under the sculpture to homogenize the white balance and adjusting brightness in order to make the levels in different pictures more uniform, we are able to compare and follow the yellowing of this piece in time (Figures 16 – 19.).

Figure 16. Homogenized picture. Original: EMMA / Katja Honkanen.

Figure 17. Homogenized picture. Original: EMMA / Ari Karttunen.

Figure 18. Homogenized picture. Original: EMMA / Ari Karttunen

Figure 19. Homogenized picture. Original: EMMA / Marianne Miettinen.

It may be noticed that the levels in the pictures are still not exactly the same across the four samples, but it is very likely different light settings were used when these pictures were taken, and thus it is not possible to obtain perfectly matching levels. Nevertheless, they are now close enough for a comparison to be possible.

The pictures show that *Läpinäkyvä tarjoilija* gradually yellowed during the almost 9 years (from July 2006 to March 2015) it was exposed at EMMA's exhibition (SSKO:1692 Läpinäkyvä tarjoilija 2006). During the last years of the permanent exhibition, the level of lighting was increased (above the recommended lux levels for plastics), which may be linked to the apparently faster rate of yellowing of the piece during this time. Taking this into account, it is reasonable to believe that the yellowing would have been slower, had the same lighting conditions be maintained. The amount of yellowing observed in the last picture (which can be more accurately measured, since a colour calibration target is present) is still marginally acceptable for the artist, who does tolerate a certain amount of yellowing due to aging to her tape sculptures, as long as the ethereal feeling is still transmitted (Nieminen, 2020).

Based on all this, an *ideal state lifespan* of around 12-13 years may be a conservative estimate for the material and aesthetic integrity of Inka Nieminen's tape sculptures. After this time, the sculptures may still stay structurally sound for many more years, but the yellowing is such that the original meaning of these sculptures is not conveyed in the same way anymore, and the artist would rather they are not displayed (Nieminen, 2020). Of course, this does not mean they are no longer exhibitable, as EMMA's Chief Curator of collections Henna Paunu explained earlier on.

3.2.5 Lifespan analysis: conclusions

When it comes to the *ideal state lifespan* analysis of *Suonisto* and *Turkis*, we have reference pictures from four points in time: the exhibition in Mänttä in 2006 (Figure 1.), the documentation process upon acquisition in 2006 (Figure 2 & 3.), the catalogue shooting by EMMA's photographer in 2009 (Figures 4 & 5.) and documentation conducted in conjunction to this Bachelor's thesis in 2019 (Figures 6 & 7.).

In chapter 3.2.4 it has been established that 12-13 years would seem to be a reasonable estimate for the *ideal state lifespan* of these sculptures, but in the pictures taken by EMMA's photographer in 2009 (Figures 4 & 5.) it is clear that *Suonisto* and *Turkis* had already reached the end of it. The degree of yellowing they had attained in only 5 years (or less) is clearly deeper than that of the reference sculpture after 12 years (Figures 20 – 22.).

Figure 20. Suonisto in 2006. Picture: EMMA / Ari Karttunen

Figure 21. Turkis in 2006. Picture: EMMA / Ari Karttunen

Figure 22. Läpinäkyvä tarjoilija in 2015. Picture: EMMA / Marianne Miettinen

If these two sculptures have yellowed more in 5 years (or less) than another one (made by the same artist and using the same technique and materials) in 12 years, it may be concluded that **something has accelerated their degradation process**. Moreover, they have been kept in storage at the museum during this time, so **it is reasonable to believe the accelerated yellowing and degradation has been due to unsuitable storing conditions and/or materials**. This will be further researched in chapter 4.

4 Material analysis and research

In this section I will try to determine which factors have had the most impact in the premature yellowing and degradation of the case study objects, artist Inka Nieminen's transparent tape sculptures *Suonisto* and *Turkis*.

4.1 Degradation and aging of plastics

In order to study the degradation mechanisms of these artworks, the most common degradation processes plastics are subject to will be examined. It is also worth pointing out that other polymer-based materials, such as glues, are also subject to the degradation processes that affect polymer chains in plastics.

4.1.1 Challenges and misconceptions

Currently plastics and the environmental threat they present are almost constantly in the media, and with good reason, as many plastics require hundreds of years to completely

decompose. In addition, a common misconception is that plastics are such a new material that they do not require conservation. Nevertheless, we are all probably familiar with plastics turning yellow, foams crumbling, or plastic surfaces becoming sticky. These are just a few examples of visible degradation of plastic materials.

Degradation can take many forms and can be linked to many factors. These include possible contamination of the material and the harsh physical conditions during the manufacture process, the use and degrading factors the object may have been subjected to during its lifespan and the additives it contains (Kutz 2012, 63 – 64; Waentig 2008, 150 – 151). It should also be taken into account that different degrading factors may have different effects when applied individually, to the effects they have when applied in combination with one another. As a result, properly replicating the effects of long-time exposure to degrading agents such as light may be challenging, and it is still not possible to accurately predict the aging behavior of specific plastics over a longer period of time (Brydson 1999, 99). Shashoua (2008, 153) divides degradation processes in three groups depending on the factors leading to the degradation, but it should be kept in mind that many of these degradation processes can occur (and often do occur) together and, for example, surface damage due to physical degradation can lead to chemical degradation by trapping dirt and moisture. The main characteristics of these degradation mechanisms will be listed below, but a useful table detailing the effects of the most damaging of them on different plastics can be found in Shashoua's book (2008, 62 – 64). (Shashoua 2008, 154; Morgan 1991, 15).

4.1.2 Degradation linked to physical factors

This category comprises degradation due to mechanical stress, changes in temperature and/or humidity and migration of additives to the surface (Shashoua 2008, 153).

Many of the plastic objects we encounter today have been created with a specific use in mind, which they have most likely performed for a number of years before entering museum collections. This use may have involved repeated handling, bending and stretching of the material, which usually leads to changes in both the appearance and the durability of the plastic. (Shashoua 2008, 153 – 154.)

Plastics can also react to temperature, moisture and other materials they are in contact with, and how they react depends on their chemical composition. If the solubility of

substances in contact with the surface is similar to that of the plastic, some of these substances can be absorbed into the body of the material, leading to changes in colour and tackiness. Besides, increases in temperature can make thermoplastic materials exceed their glass transition temperature and deform, and fast changes in temperature can lead to brittleness. Fast changes in temperature are also especially threatening to composite objects, where each material expands and shrinks at a different rate. In addition, higher temperatures can also accelerate the rate of chemical degradation processes (Sashoua 2008, 168 – 170). In turn, changes in humidity can induce swelling and shrinkage in many of the early plastics, leading to crazing and breaking of the material, and can also affect many of the additives. (Shashoua 2008, 154 – 159; Waentig 2008, 153.)

Additives are combined with the plastic during the manufacturing process, but some of these additives may evaporate or migrate to the surface overtime due to solubility incompatibilities. This degradation process leads to the plastic losing many of its desired properties, and often makes the material brittle. When the additives migrate to the surface, they usually deposit on it, creating layers of solidified or tacky substances, which can in turn initiate their own degradation processes by trapping dust and pollutants. (Shashoua 2008, 159 – 161.)

4.1.3 Degradation linked to chemical factors

This kind of degradation is characterized by chemical reactions, resulting in changes to the chemical structure of the material. Oxygen, ozone, water, metals and electromagnetic radiation can all react with plastics, and different plastics may react in very different ways to these factors. The main changes to the chemical structure of the polymers in plastics are the breaking of the polymer chains (resulting in shorter-chain polymers and crumbling), cross-linking (leading to loss of elasticity and brittleness), development of chromophoric groups (linked to changes in colour) and development of polar groups. (Shashoua 2008; 162 – 166.)

One of the main factors leading to the degradation of plastics is light, especially in the ultraviolet region of the spectrum. The wavelengths of UV-light are able to break many of the bonds between atoms in polymer chains, namely C—C and C—O (which are the main links found in the polymer backbones). This kind of degradation is often linked to changes in colour and yellowing, through absorption of UV light by chromophore groups

such as carbonyls (C=O) and unsaturated carbon links (C=C). (Shashoua 2008; 166 – 168; Waentig 2008, 152.)

An especially difficult degrading factor to avoid is oxygen, since it is present in the very air we breathe. The oxidation of plastics depends on their chemical structure, with crystalline structures and saturated bonds being more resistant to it, and it is usually accelerated by the presence of light, heat and metals. The main danger of this kind of degradation is that it is autocatalytic, which means the degradation products of the reaction enable new reactions, thus accelerating the whole process. This kind of degradation can also create chromophoric groups and discolour the material, also leading to brittleness and crazing. (Shashoua 2008, 171 – 175; Waentig 152 – 153.)

Hydrolysis, or the breaking of bonds through the chemical reaction with water, is another one of the degradation processes that can be encountered. This kind of reaction usually affects polymers that have been produced through condensation polymerization, in which water is the product of the creation of links between monomers. Accordingly, water is able to severe those links between monomers, and cause chain scission. (Shashoua 2008, 175.)

4.1.4 Degradation linked to biological factors

While most plastics are rarely targeted by microorganisms (thus making their biodegradation especially lengthy), some fungi and bacteria are actually able to consume certain kinds of plastics or components in them. Additives are most frequently targeted, especially additives such as plasticizers, that often end up migrating to the surface. These microorganisms can create biofilms on the surface of the material, and the surface damage related to these attacks can often lead to weakening the material further, which in turn reduces its resistance to other kinds of degradation, for example, water damage. (Shashoua 2008, 176 – 177; Kutz 2013, 260 – 262 & 264 – 266.)

4.2 Case study: FTIR analysis

In order to limit the scope of this study, only the transparent parts of the sculptures will be analyzed, since these are the ones showing the most visible signs of yellowing and degradation. In addition to that, the degradation due to shrinking and surface deformation mentioned earlier will not be looked into either. According to the artist (Nieminen 2020) this kind of degradation occurs as a consequence of the production technique and already appears a couple of months into the lifespan of the artworks, so it is unavoidable and was not affected by (possible) unsuitable storage conditions and/or materials at the museum.

The next step involves the identification of the materials these transparent sculptures are made of. To this purpose, Fourier Transform Infrared Spectroscopy (FTIR) will be used. This method directs infrared light at the material and returns a spectrum of the wavelengths that are absorbed by it. Comparing this spectrum with those of reference materials, many organic compounds can be identified, at least at a basic level. Compounds with very similar chemical structures and bonds may not be differentiated with this method. (Derrick, Stulik & Landry 1999.)

4.2.1 Tape

We know from Nieminen (2020), that 3M Scotch® 550 Transparent tape was used to create these artworks. Adhesive tape is a complex material with different layers and components. The tape used in this case is a one-sided adhesive film tape. Most one-sided tapes consist of a carrier (in this case the plastic film) and a pressure-sensitive adhesive. Optionally, tapes may also include a primer and backsize. The function of the primer is to bond the adhesive to the carrier, and the backsize facilitates the unwinding of the tape from the roll. (Gierenz & Karmann 2008, 117.)

In the case of 3M Scotch® 550 Transparent tape it is possible that it includes all four components. It was nevertheless not possible to get information on the primer nor the backsize, and it was therefore decided that, for the purpose of this study, only the carrier and adhesive would be looked into. This is not ideal, since it is possible the primer and/or backsize may have played a role in the degradation process.

In addition, it was revealed during the artist interview (Nieminen 2020) that the manufacturer modified the product sold as 3M Scotch® 550 Transparent tape at some point around 2010. According to the artist, the number of layers she used to apply around the time when the case study subjects were created is not enough to obtain a firm enough shell anymore, and almost twice the number of layers are needed with the product currently available. Nevertheless, and because obtaining the exact same material is not possible, the tape currently sold as 3M Scotch® 550 Transparent tape will be examined instead. The manufacturer of the tape (3M Finland) was contacted in order to obtain more information about the nature of the changes and was asked whether the carrier film is nowadays thinner but still the same composition-wise. Unfortunately, they did not want to disclose information about their product. Old stock tape from 2004 was also enquired of, but the manufacturer answered that they do not keep such old products in storage. (Salminen 2019.) Thus, it is possible the outcome of the research performed using the 3M Scotch® 550 Transparent tape bought in 2020 is not fully applicable to the material *Suonisto* and *Turkis* are made of, but the research will from now on be conducted assuming the materials are similar enough to draw the same conclusions.

The two main components (the carrier film and the adhesive) of 3M Scotch® 550 Transparent tape were analyzed. They were separated from each other with the help of a cotton swab dipped in acetone and a scalpel. The FTIR analysis of the carrier was conducted by (after removing the glue) folding it in two with the back (non-adhesive) side of the carrier facing out.

With the help of the FTIR analysis, the carrier was unequivocally identified as polypropylene. A perfect match for the glue was not found within the collection of reference sample spectra available in the computer of the chemistry laboratory of the conservation department of Metropolia, but it is at least possible to say it is an acrylic-based glue. A more detailed analysis of the composition would be possible through gas chromatography spectrometry, but it was not considered vital for this study. The FTIR analysis spectra for the carrier and glue can be found below (Figures 23 & 24.).

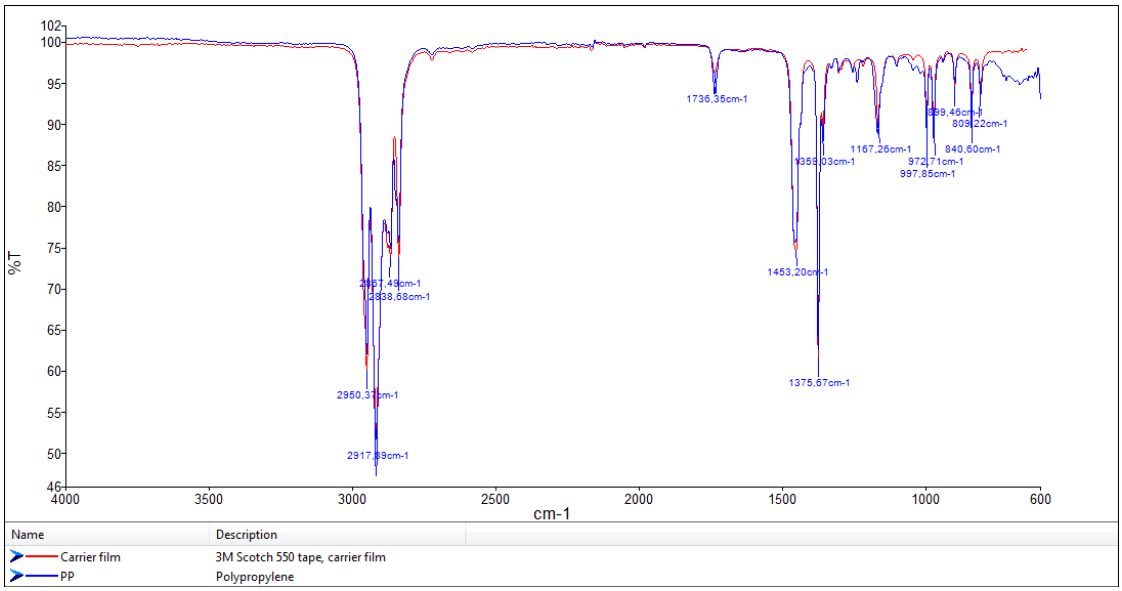


Figure 23. FTIR spectra of the carrier film (3M Scotch® 550 Transparent tape) and a polypropylene reference sample.

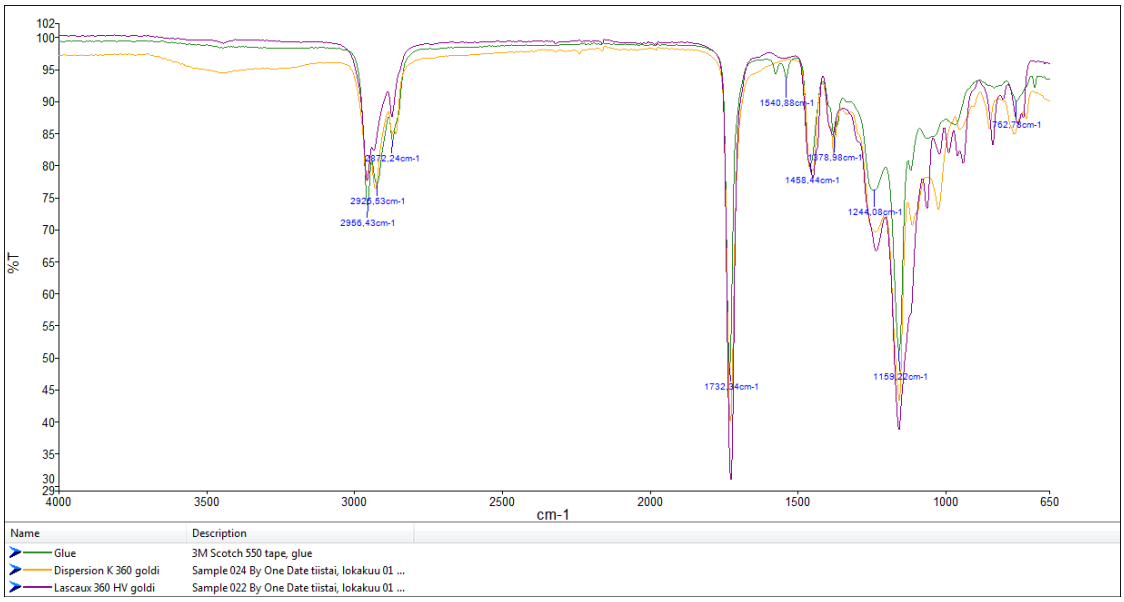


Figure 24. FTIR spectra of the adhesive and two acrylic-based glues from the reference library.

4.2.2 Cling film

The cling film was described by the artist as Elmu®kelmu, which is a common Finnish brand of cling film. According to the producer (Aito ja alkuperäinen Elmu®kelmu | Säilytys | Fredman, 2020), this product is a low-density polyethylene (LD-PE). It was nevertheless also tested with the FTIR spectrometer, the resulting spectrum can be found below in Figure 25. With the spectra obtained it is not possible to say if the cling film is high- or low-density polyethylene, but it does verify it is polyethylene.

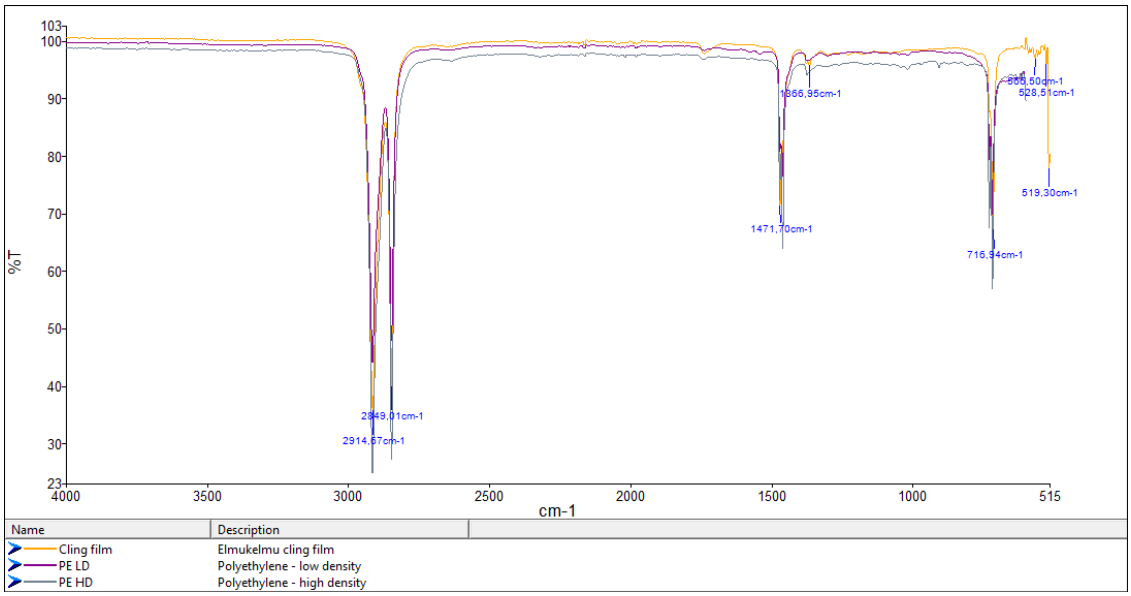


Figure 25. FTIR spectra of the cling film Elmu®kelmu, a low-density polyethylene reference sample and a high-density polyethylene reference sample.

4.2.3 Melted material (polyblend)

The material these sculptures are made of is actually a mixture of all three, the polypropylene carrier film and acrylic-based adhesive of the 3M Scotch® 550 Transparent tape, and the low-density polyethylene of the cling film. By melting these materials together (two plastics and a polymer-based glue), a polyblend is formed. In order to conduct further material analysis and aging tests, a mockup sheet was produced using the same method the artist uses. Following the artist's wishes, the full method will not be disclosed here (Nieminen 2020). Nevertheless, and for the purposes of clarity, it is necessary to divulge that the tape is applied on top of the cling film before they are melted together, and it is likely very little (if any) of the cling film can be found on the surface of the objects. The likely exceptions are the areas where so much heat was applied, that it burnt through the material, leaving a hole in the shell (Appendices 2 & 3.).

The FTIR analysis was conducted by facing the tape side of the melted material against the device's diamond. This decision was made based on the fact that this spectrum will later be compared to samples taken from the case study objects, and these will be collected from the surface. Spectra of the polyblend both before and after applying the varnish were analyzed and compared to the reference spectrum of the urethane alkyd varnish used, Tikkurila's Unica Super 20 (Appendix 5.). It may be noticed that the spectrum of the unaged varnished material shares traits of the other two (Figure 26.).

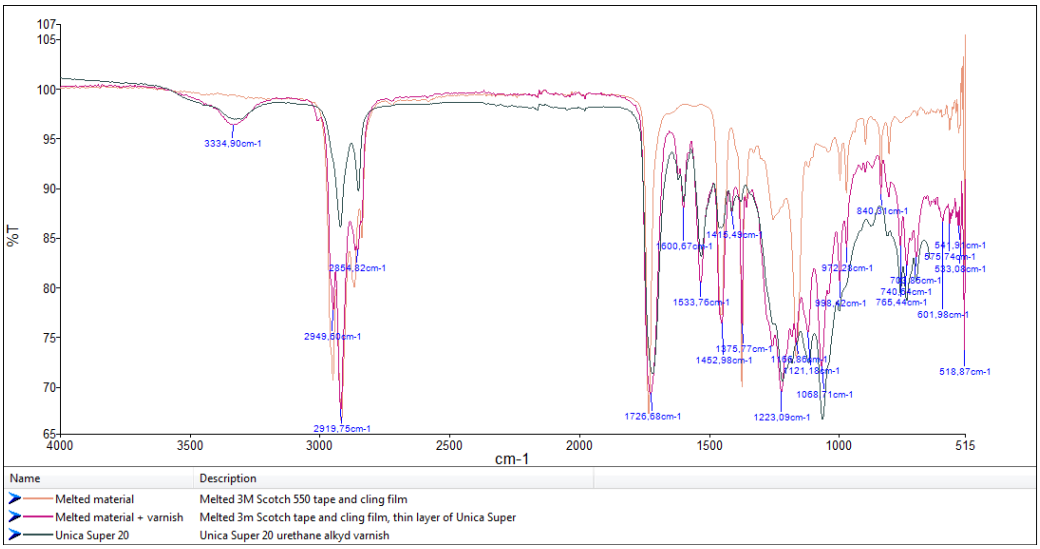


Figure 26. FTIR spectra of the unaged melted material with and without the varnish, and the reference spectrum of the urethane alkyd varnish Unica Super 20.

4.2.4 Samples from *Haute Couture*

Finally, samples of the case study objects were taken and analyzed with the FTIR spectrometer. The samples were taken from the surface of areas that were more homogeneously melted and yellowed, in order to ensure the degraded component would be present. Two samples were taken from *Suonisto*, and two from *Turkis*. The spectra are very close matches (Figure 27.) so, in order to facilitate readability of spectra in future comparisons, one of them (Turkis 2) will be used as a representative of the aged melted material.

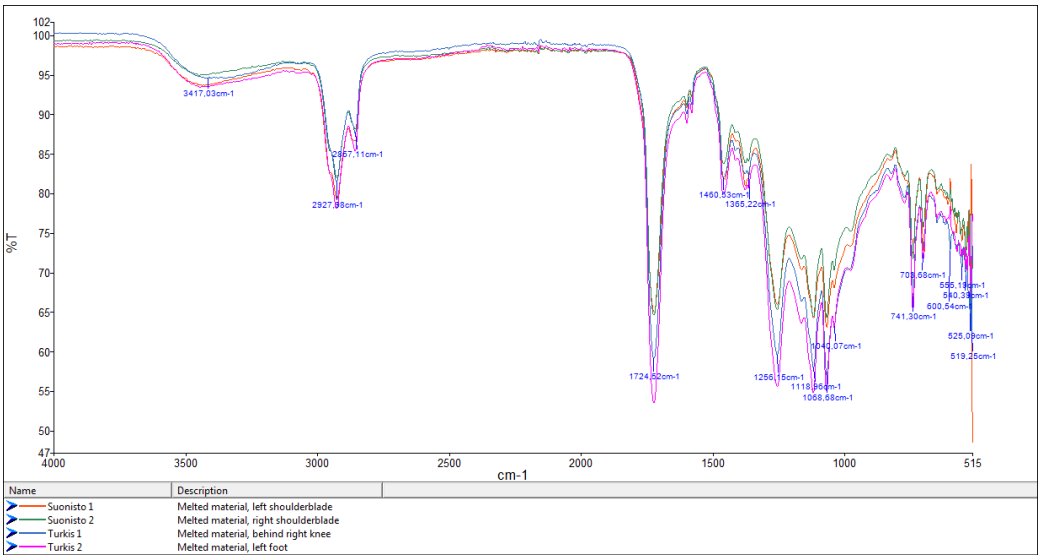


Figure 27. Spectra of the samples of melted material taken from Suonisto and Turkis.

The aged polyblend was also compared to the unaged polyblend created for this study (Figure 28.). It can be observed that they do share many characteristics, but at this point it is impossible to determine if the differences are due to the chemical degradation of the aged material or variations in the composition of the components.

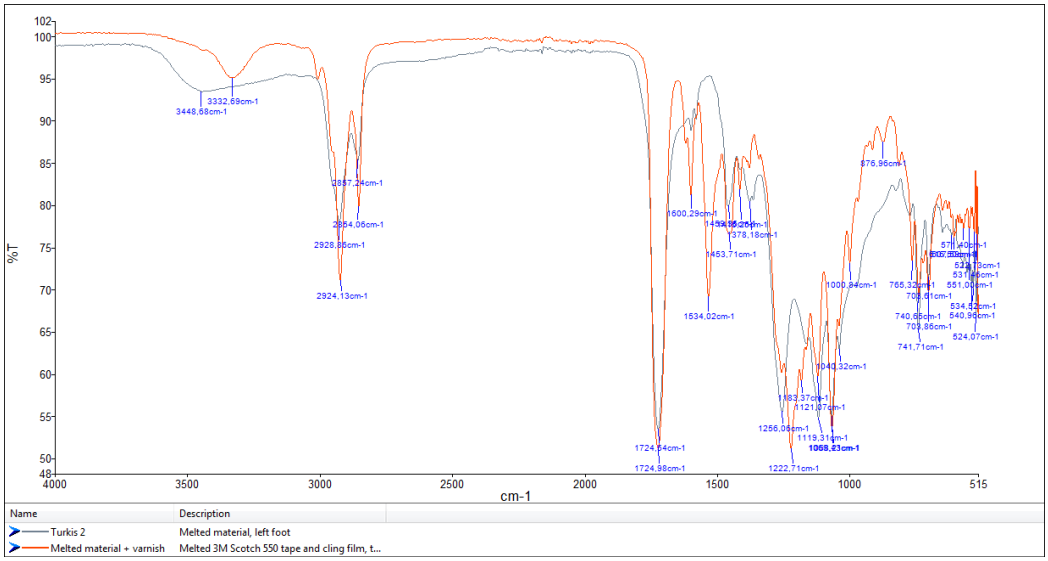


Figure 28. Spectrum of the polyblend sample taken from Turkis, compared to the spectrum of the unaged varnished polyblend created for this study.

In addition to that, samples of the dark yellow fluid observed in the less melted areas were collected. These samples were also analyzed with the FTIR spectrometer, and the spectrum compared to that of unaged glue (Figure 29.).

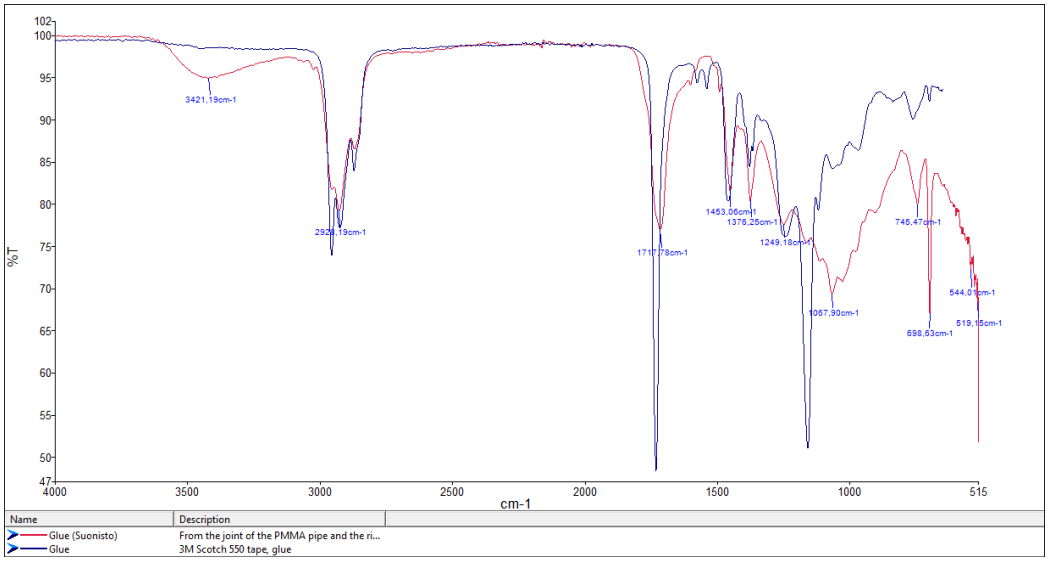


Figure 29. Spectra of the aged glue collected from Suonisto and the glue collected from new unaged 3M Scotch® Transparent tape.

While these spectra do have similarities, it was also noticed that the spectrum of the aged glue is in fact quite close to that of the aged melted material. This may reflect how much of the glue is actually present in the polyblend, but it may also be due to the fact that the composition of the glue may have been changed around 2010, when the artist noticed changes in the product sold as 3M Scotch® Transparent tape. Thus, a sample of the aged not melted tape was also taken, and all three spectra compared (Figure 30.).

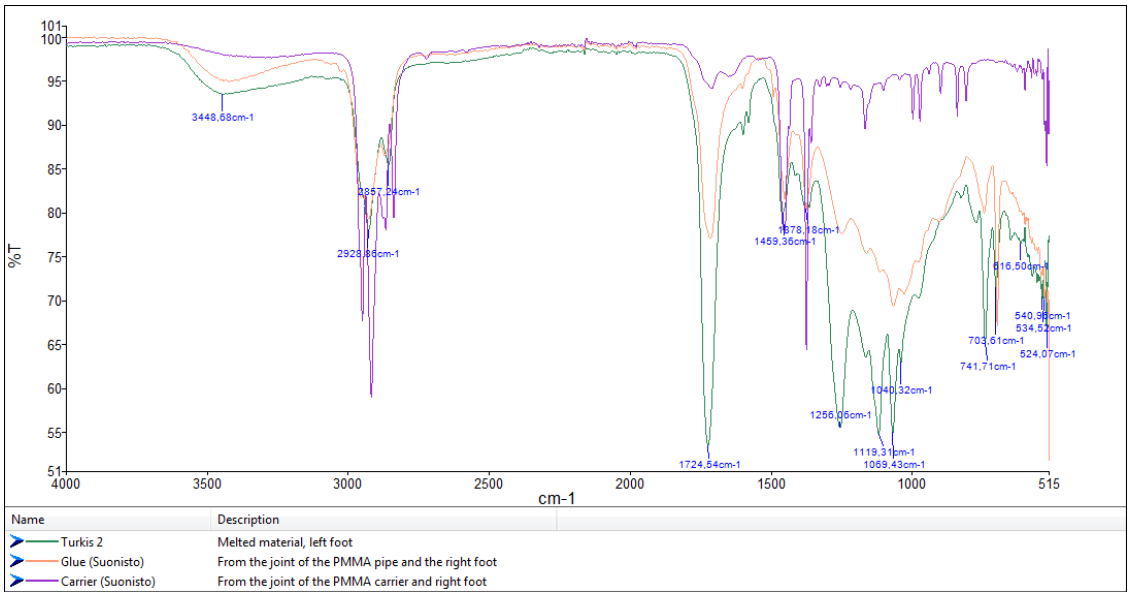


Figure 30. Spectra of the samples of aged material collected from Suonisto and Turkis.

It may be observed that the spectra of the polyblend seems to be closer to that of the glue than that of the carrier. This may suggest that the glue is thoroughly blended with the carrier in the polyblend. It is worth mentioning that that all samples taken from *Suonisto* and *Turkis* display a peak around 1725 cm^{-1}. This peak corresponds to the carbonyl group (C=O), which is cromophoric and often involved in the yellowing of plastics during aging. While the carrier film's peak is not very pronounced, it is very strong in the case of the glue and aged polyblend samples. These two samples also show much stronger yellowing than the carrier sample (which had not been melted). In addition to this, it is worth mentioning that the FTIR curve of the cling film (Figure 25.) doesn't even show a peak in the carbonyl group band 1850 – 1650 cm^{-1} (Derrick, Stulik & Landry 1999). As a result, it is reasonable to believe that **the glue may be the component that has contributed the most to the yellowing of the polyblend**.

4.3 Case study: Research on the degradation of the material

4.3.1 Degradation mechanisms of the polyblend

In chapter 4.2.3 it has been determined that the melted material is a polyblend composed of the polypropylene carrier film and acrylic-based adhesive of the 3M Scotch® 550 Transparent tape, and the low-density polyethylene of the cling film. Before looking at the possible degrading factors contributing to the accelerated aging of these sculptures, the customary aging and degradation mechanisms of these components will be considered.

Polypropylene is resistant to many chemicals and solvents that are usually harmful to other plastics, but some gases (such as CO_2, volatile hydrocarbons and chlorinated hydrocarbons) can make it swell. It is also very sensitive to UV-radiation, and suffers from discolouration, embrittlement and surface cracks after just a few weeks of exposure. In addition, it can also suffer from thermo-oxidation in temperatures above 100 °C. Both UV-radiation and thermo-oxidation lead to the creation of carbonyl groups, which are chromophoric and thus linked to yellowing. (Waentig 2008, 298 – 299.) Nevertheless, it is unlikely that either of these degradation processes have occurred to these sculptures while in storage at the museum and it is reasonable to believe that they can be dismissed.

Polyethylene shares most of the properties of polypropylene, and it is thus not surprising that it also shares most of its degradation and aging mechanisms. Polyethylene is usually more resistant to aging than polypropylene, and while it is still very sensitive to UV-light, it is so in less degree than polypropylene. (Waentig 2008, 296 – 298.) It may therefore be assumed the conditions in the museum storage were not able to prematurely yellow this component either.

Evaluating the degradation and aging mechanisms of the tape's glue is much more challenging, since the FTIR analysis was only able to point out it is an acrylic-based glue. It is nevertheless possible to have a look at the acrylate group, which is present in acrylic materials. The acrylate group is most often an ester, to which vinyl groups are attached (Acrylates, 2013). The ester group contains a carbonyl group (C=O), and the vinyl groups contain unsaturated carbon bonds (C=C). Both of these are chromophoric groups, so it is reasonable to believe the acrylic glue will be prone to yellowing.

Of course, it is necessary to keep in mind that the mixture of the components will not necessarily degrade in the same way the individual components do. On the other hand, yellowing is due to chemical degradation, which is linked to changes in the polymer chains and cross-linking between them. Both plastics involved in this polyblend are thermoplastics, which means they can melt and solidify without suffering notable changes to their chemical structure. We do not know what temperature was used to melt them together but, considering there are areas that are not even properly melted, we could assume the temperatures weren't high enough to noticeably change their chemical structure. Unluckily enough, it is not possible to estimate what kind of effect the melting of the glue may have had in the properties of the final melted material. It is nevertheless reasonable to believe **the environmental conditions in the storage of the museum are unlikely to have been responsible for the accelerated degradation of these sculptures**.

4.3.2 Possible factors contributing to the accelerated degradation

In order to study which factor or factors may have had the most influence in the accelerated yellowing of *Suonisto* and *Turkis*, and since environmental conditions have been discarded, the packing conditions of the objects will be considered. The objects were packed in a box made of ordinary packing cardboard, that had a front wall made of bubble wrap. The objects shared the box with painted metallic stands (also made by the artist) and had a couple of brick-sized blocks of discoloured (in 2019) polyurethane foam between the stands and their feet. In the documentation written by the conservator, who conducted the condition check of the objects, it was noted that the paint (Betolux, Appendix 5.) had not completely dried yet, and that two holes had been made to the ceiling of the box in order to let possible volatile gases out (SSKO:1971 Suonisto 2006; SSKO:1972 Turkis 2006). No such holes were found upon inspection when the boxes were opened in order to begin the documentation process of the sculptures in November 2019. It was noted however, that the packing tape used to keep the boxes closed was very dry on the outside of the box and extremely tacky in the inside, **which points towards gases having built up inside the boxes**. The gases may have come from the normal aging and deterioration processes of the material itself, the natural degradation of the cardboard, the moist painted stands, the polyurethane foam or a combination of these.

The cardboard the boxes are made of is not acid-free, so it has most likely released acidic gases, which may in turn have chemically degraded the material or accelerated the normal aging process. Bubble wrap is most often made of low-density polyethylene (Granger 2018), which is the same kind of plastic as the cling film and thus especially resistant to aging. The bubble wrap sheet used in the box shows no visible signs of deterioration and should not emit any gases. It will therefore not be considered a possible degrading factor.

There are two kinds of polyurethanes, polyester urethanes and polyether urethanes. Polyether urethanes degrade through photo-oxidation, which in the case of the museum's storage facilities is negligible. Polyester urethanes degrade through hydrolysis, and produce acid fragments that act as catalysts, accelerating the degradation reaction further. When polyester urethanes degrade, they quickly become brittle and crumble, which is not the case of the polyurethane pieces found in the boxes. (van Oosten 2011, 13 – 14 & 42 – 45.) We therefore assume that, despite the yellowing, they have not degraded enough to actually be a factor in the acceleration of the sculptures' degradation. Furthermore, the sculptures were already fully yellowed in 2009 (Figures 4 & 5.), and the condition of the foam was probably much better back then. The foam may have degraded influenced by the same microclimate, present in the boxes, that has affected the sculptures.

We know from the artist (Nieminen 2020) that a layer of Hempel boat lacquer with UV-protection was applied to the surface of both sculptures. Unluckily enough she does not remember the exact product, but it is most likely an oil alkyd or urethane alkyd lacquer (Hempel.fi 2020). While it is possible the lacquer may have had a part in the degradation of the material, it was also applied to *Läpinäkyvä tarjoilija*. This sculpture has been used to establish these kinds of sculptures should have an *ideal state lifespan* of at least 12-13 years and degraded at a much slower rate than *Suonisto* and *Turkis*. Therefore, the lacquer will not be taken into account as a possible factor in the accelerated degradation process (even though it will be used in the production of the mockup test material).

Taking all this into account, these are the factors that will be looked into as being linked to the accelerated yellowing of the polyblend:

- Lack of ventilation due to storage in a closed box

- Acidic gases released by the cardboard box

- Gases released by the still wet paint

4.3.3 Testing of the possible factors in mock-up samples

As Shashoua writes in her book (2008, 168), thermal degradation is the most common kind of degradation in museums, since UV-radiation is usually dealt with appropriately. This is especially true for museum storages such as EMMA's, that are underground and lit (with artificial light) only when people are at work in situ. That is why, in order to study the possible effect of these agents, accelerated aging tests (using heat) were conducted on mockup testing samples in the laboratory. These tests were conducted during the COVID-19 pandemic, so exact matches for the boat varnish (which is also unknown, except for the manufacturer) and paint could not be obtained, and others were used instead. Nevertheless, products were carefully chosen in order to recreate the storage conditions as accurately as possible.

The boat varnish used by the artist, an unknown Hempel boat varnish with UV-protection, and most likely an oil alkyd or urethane alkyd varnish, was replaced with Tikkurila's Unica Super 20, which is a urethane alkyd varnish with UV-protection. The paint used by the artist to paint the stands, Tikkurila's Betolux, was replaced with Tikkurila's Empire. While Betolux is a urethane alkyd paint, and Empire is an alkyd paint, they share the same thinners and the rest of the components are also almost identical. This is why we will assume they would both release the same gases into the box. Information and composition of both paints and the lacquer used can be found in Appendix 5.

A. Sample details

The samples were produced using the method the artist developed for her sculptures (Nieminen 2020). Following the artist's wishes the method shall not be fully disclosed in this thesis. 3M Scotch® 550 Transparent tape was applied on top of Elmu®kelmu cling film and they were melted together with a hot air gun. Subsequently a thin layer of Tikkurila's Unica Super 20 urethane alkyd varnish was applied, and the sheet was cut in 19 x 19 mm^2 pieces with a utility knife. The samples were prepared on the same day the accelerated aging tests began, and the varnish was allowed 3 hours to dry before the samples were placed in the heating chamber.

In addition to the polyblend samples, glue from the 3M Scotch® 550 Transparent tape was also tested. The glue was harvested from the tape with the help of a cotton swab dipped in acetone and a scalpel, and placed on glass microscope slides.

B. Test method

The standard ISO 188:2011 (SFS Online 2011) for accelerated aging and heat resistance tests for rubber was used as a reference and modified to suit the needs of the test at hand. Method A of this standard was chosen, using a cabinet oven with low air speed and an adjustable exhaust air flap, at a temperature of 60 °C. This way, the risk of triggering additional heat-related degradation mechanisms was minimized.

The degradation of the test samples was studied by measuring and comparing the yellowing of samples in different environments. Pyrex glass containers (0,8 L) with polypropylene lids were used in order to simulate lack on ventilation in the environments that required it. The environments chosen were:

- Environment 1: Outside the oven (reference sample)
- Environment 2: In the oven, with limited ventilation through the oven's adjustable exhaust air flap
- Environment 3: In the oven, inside an airtight container
- Environment 4: In the oven, inside an airtight container, with a 10 x 10 mm^2 piece of the same kind of cardboard used to store the sculptures
- Environment 5: In the oven, inside an airtight container, with 10 g of Tikkurila's Empire alkyd paint (Appendix 5.)
- Environment 6: In the oven, inside an airtight container, with a 10 x 10 mm^2 piece of the same kind of cardboard used to store the sculptures and 10 g of Tikkurila's Empire alkyd paint

For the glue only three environments were chosen: environments 1, 2 and 6. The reason for this is that this glue will only be used for FTIR analysis.

C. Test details

The accelerated aging test was implemented in a Binder heating chamber (Model FD 23), at a constant temperature of 60 °C. In order to be able to follow the yellowing of the samples, a visible light spectrophotometer (Konica's Minolta CM-A145) was used to measure the colour of the samples during the aging process. Measurements were taken after 24 hours, 48 hours, 72 hours, 1 week, 2 weeks, 3 weeks and 1 month. In order to conduct the measurements the samples had to be taken out the oven and containers, and the measuring process took around 30 minutes each time. A total of 12 samples were used, two per environment (Figure 31.).

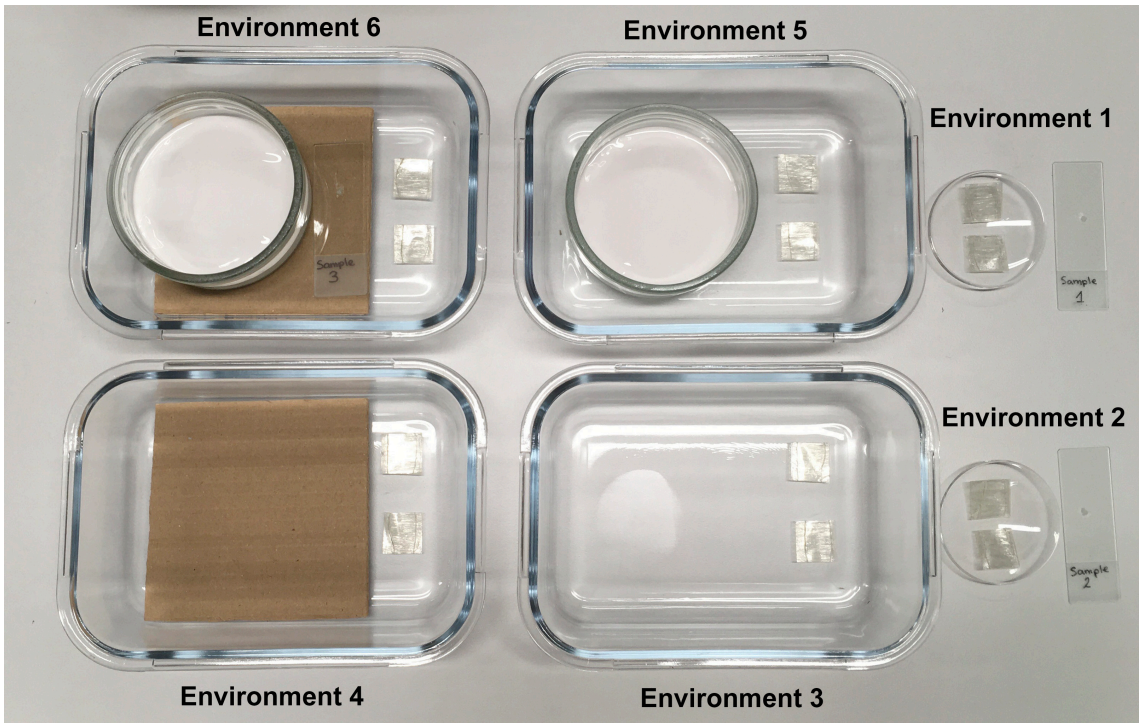


Figure 31. Setup for the accelerated aging tests on the mockup sample pieces and glue.

D. Test results

The values of all three variables measured in the VIS spectrometry (*L*, *a* and *b*) can be found in the appendices (Appendix 6.). The variable *b* is directly linked to the amount of yellow in the measured samples, so the other variables will not be considered in this study. This variable takes values from -100 to 100, where 0 is white, -100 is blue and 100 yellow. Therefore, the higher the number, the higher amount of yellow there is in the sample. (What is CIE 1976 Lab Color Space? 2020.)

The initial value of *b* was measured from one of the samples and established as initial value for all test pieces, since they were all cut from the same material. The change in the value of *b* for the unaged sample (Environment 1) is negative (and therefore "impossible"), but this is probably due to the irregular surface of the mockup material and can most likely be considered to be 0%. Initial and final values can be found in Table 3.

Table 3. The initial (x_0) and final (x_a) values of *b* (and their standard deviation, SD) for all six test environments, as well as the changes in the property values, as percentage. This percentage is calculated using the expression $\frac{x_a - x_0}{x_0} * 100\%$.

	x_0	SD (x_0)	x_a	SD (x_a)	%
Environment 1	6,28	0,0143	6,12	0,0366	-2,5% (0%)
Environment 2	6,28	0,0143	8,13	0,1107	29,5%
Environment 3	6,28	0,0142	8,25	0,0686	31,4%
Environment 4	6,28	0,0142	9,83	0,1120	56,5%
Environment 5	6,28	0,0143	10,75	0,1003	71,2%
Environment 6	6,28	0,0143	11,42	0,2334	81,8%

E. Test date

The tests were conducted during a period of a month, starting on the 14th April 2020 and ending on the 14th May 2020. Measurements were also taken on the 15th, 16th, 17th, 21st and 28th of April and the 5th of May 2020.

4.3.4 Analysis of the results

All three factors suspected (lack of ventilation, the packing cardboard and the gases released by the moist paint) were proven to have accelerated the yellowing of the mockup polyblend material. Of these three, the effect of the lack of ventilation was least strong in the tests conducted. It is very likely the difference may have been stronger if it would have been possible to keep the containers sealed throughout the whole testing period, but the VIS spectroscopy measurements required opening the containers in order to be performed. This, of course, "ventilated" the studied environments every time measurements were taken. In addition to that, the sample in environment 2 (inside the oven, but not in a sealed container) was probably not exposed to sufficient ventilation, as the oven's adjustable exhaust air flap is relatively small. Nevertheless, the combined effect of all three factors proved to be the most harmful, as was to be expected. The samples before and after aging can be seen below, and the accelerated yellowing of some of them is apparent also to the naked eye (Figures 32. & 33.).

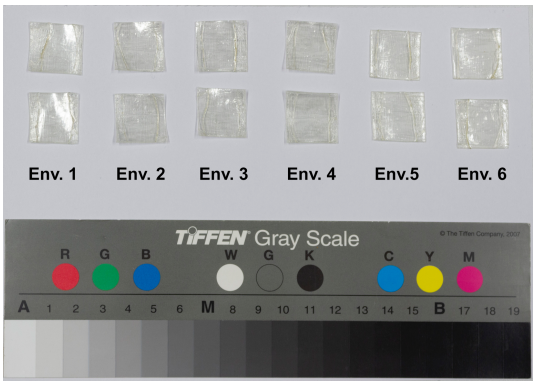


Figure 32. Mockup test samples before artificial aging.

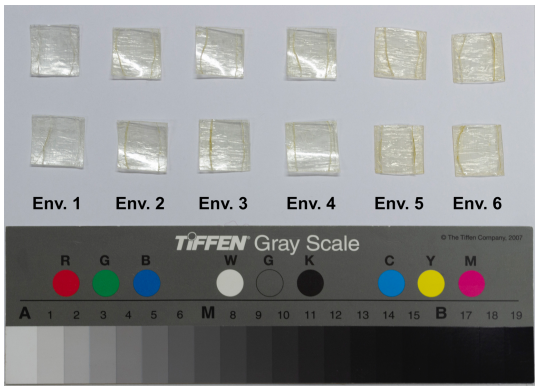


Figure 33. Mockup test samples after artificial aging.

FTIR analysis of the mockup samples (environments 1 – 6) and glue samples (environments 1, 2 & 6) were also performed (Appendix 7.), but the spectra were too similar to each other and nothing can be established by looking at them in this case. The yellowing of the glue in environment 6 was nevertheless apparent, which supports the hypothesis that it is the component in the polyblend which is most sensitive to that form of degradation (Figure 34.).

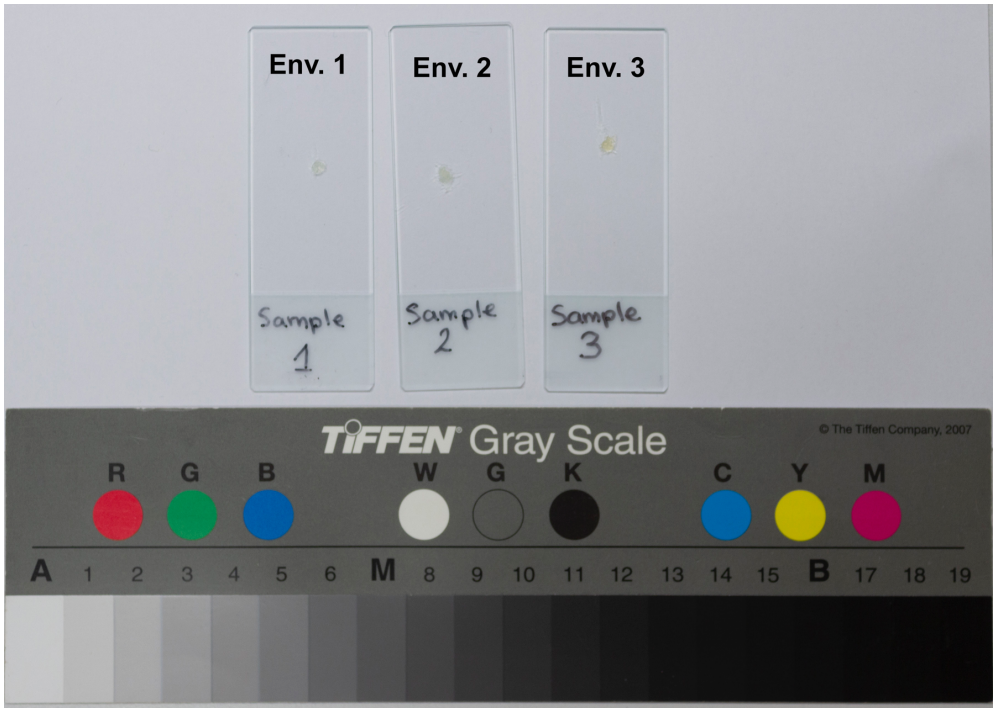
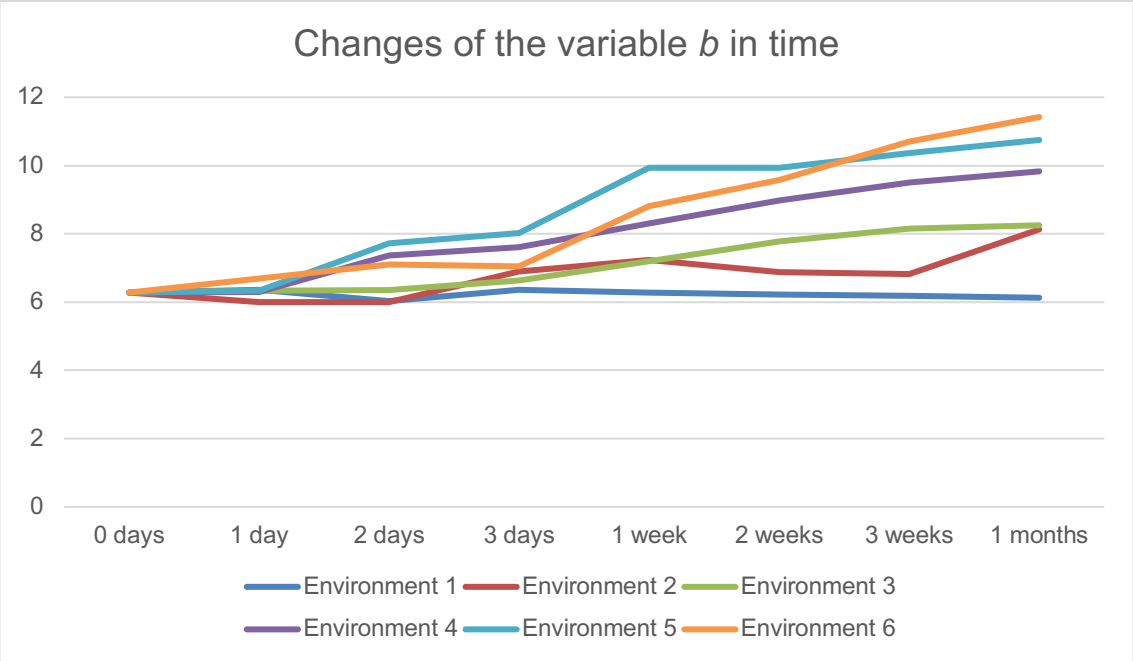


Figure 34. Glue samples after artificial aging tests in environments 1, 2 and 6.

Finally, the yellowing of the mockup test samples in time will be looked at (Chart 4.). An interesting detail of this process is that the sample in environment 6 (with both paint and cardboard present) initially yellowed at a slower pace than that in environment 5 (with

only paint present). It is very likely that the reason for this is that the cardboard initially acted as an absorbent, absorbing part of the gases released by the moist paint, until it reached its saturation point.

Chart 4. Evolution of the variable *b* in time, for all six environments tested.



For reasons stated in earlier sections, it was impossible to test the exact same materials that were involved in our case study. Moreover, the exact same proportions of each material (and air within the sealed containers) would have needed to be used in order to be able to point out at a single factor as the most damaging. This was not possible either, as the calculations and preparation of precise mockup samples and testing environments would have been too complex to implement. Nevertheless, the materials used were close enough to imply that **the lack of ventilation and the presence of both packing cardboard and moist paint accelerated the yellowing process, thus proving the packing design and materials implemented in 2006 were unsuitable for *Suonisto* and *Turkis***.

5 Identification and preventive conservation of plastics

5.1 Challenges and importance

It has already been mentioned that plastics are some of most unstable materials to be found in museum collections, and some can decay within just a few years. As organic materials, they are sensitive to a wide range of degradation mechanisms, that have been mentioned in section 4.1, and their lifespan decreases dramatically if kept under unsuitable conditions (Morgan 1991, 9). When changes in the material can already be detected (changes in appearance, smell or consistency (Shashoua 2008, 152)) the decay has already started. Once started, it is unstoppable. (Waentig 2008, 148.) Furthermore, active conservation of plastics is still a rather new field, and restoration of degraded objects is currently most often not possible (Waentig 2008, 167). Moreover, the degradation processes of some plastics can be harmful, not only to themselves, but also to nearby objects (Waentig 2008, 169). Thus, it is of utmost importance to provide plastics in museum collections with appropriate storage conditions, in order to safeguard them and the rest of the collection's longevity. Some advice for preventive conservation of plastic objects will be presented in section 5.3.

In the interest of providing plastic objects with adequate storage conditions, the type of plastic needs to be identified, as not all plastics thrive in the same conditions (Waentig 2008, 167 – 171). Fully identifying all the components in a plastic (additives and monomer or, in the case of polyblends and co-polymers, monomers) requires an analytic method called gas chromatography. Unluckily enough this is a time consuming and complex procedure that is unfeasible for regular use of museum professionals. Additionally, gas chromatography is a destructive analysis method, which means the analysis process destroys the sample it analyses. On the other hand, identifying the main polymer (and thus, the type of plastic) is usually enough in order to devise suitable storage conditions (Morgan 1991, 16).

A straightforward way of identifying the main type of polymer is the Fourier Transform Infrared Spectroscopy (FTIR). Unfortunately, while this analysis method is non-destructive, it does most often require taking a sample of the material, which can often be challenging when it comes to museum objects. There is also a range of microchemical tests that can be conducted and may provide more information, but they most often also require taking samples (Waentig 2008, 164 – 165). A trained eye is nevertheless able to

make an educated guess by analyzing the way the object has been manufactured, its intended use, possible signs of degradation and period it belongs to. Dating the object can also be an educated guess based on its style and appearance. (Waentig 2008, 150 – 151.)

5.2 A useful tool for identification: PIT – The Plastic Identification Tool

While books presenting different methods and flow charts on how to identify plastics are readily available (Verleye, Roeges & De Moor 2001), they often include methods and procedures that require access to a chemistry laboratory and/or equipment (in addition to a certain knowledge and know-how around it), making it impractical for everyday use in most museums. It is for this reason, that the tool that will be presented next may be especially interesting to museum professionals.

PIT – The Plastic Identification Tool has been developed in The Netherlands by the Netherlands Institute for Conservation, Art and Science, with the very purpose of providing a tool that can help museum professionals identify the main types of plastics in their collections, without the need of specialist knowledge or analytic chemistry procedures. The tool is available online and works by gathering information through a series of questions that can be answered using one's senses (smelling, looking, feeling and hearing). (Plastic Identificatie Tool | Rijksdienst Cultureel Erfgoed, n.d.; de Groot et al., 2019.)

The first choice the user is encountered with is to choose one of four possible categories: foams, elastomers, films and rigid plastics. The website includes information about each one of the categories in order to make the choice easier, should doubt arise. Every time a question is answered, the tool awards a certain amount of points to each of the plastic types included in their database and will order them in such a way, that the plastic types with the highest scores are at the top of the list. All questions need not be answered (answering some may not even be possible if, for example, touching the object is not allowed), but the more questions answered the more accurate the identification results are likely to be. Once the user has gone through as many questions as possible, the plastic type is most likely to be one of the 1 – 3 top results. A difference of at least 10 points is considered significant, in which case the accuracy of the results is likely higher. Some plastics can have very similar properties, and in this case the tool may not be able

to tell them apart, but the most likely candidates will still be on top of the list. (Plastic Identification Tool | Rijksdienst Cultureel Erfgoed, n.d.; de Groot et al., 2019.)

Optionally, the PIT-kit can be used to further improve the chances of feeding the tool with all possible information. This kit contains a wide variety of reference samples, that are used to give more precise answers to questions such as “how shiny is the surface?” or “how does UV-light interact with the surface?”. This is done by providing both the necessary tools (for example, a UV-light flashlight and polarization filters) and reference samples that can be compared to the object that is being examined. The PIT-kit is offered in conjunction with a workshop where the tool and its usage are explained and practiced, but it can also be ordered on its own, and the website also provides information about plastics and preventive conservation (Plastic Identificatie Tool | Rijksdienst Cultureel Erfgoed, n.d.; de Groot et al., 2019.)

The tool and more information can be accessed in: https://plastic-en.tool.cultureelerfgoed.nl/

5.3 Practical tips for preventive conservation

5.3.1 Preventive conservation

As discussed earlier, the single most important aspect of plastic conservation nowadays is preventive conservation, since, once the degradation process shows visible signs, it is unstoppable and irreversible. By choosing the right storage conditions for plastics and plastic-containing objects, their lifespan can be considerably increased. How can these conditions then be chosen? (Waentig 2008, 127.)

For objects made of a single kind of plastic it is more straightforward, but with composite objects it may not be possible to find a set of conditions that are favorable to all materials involved. In this case, as is usual with composite objects, a compromise needs to be reached. Typically, the most unstable or sensitive materials are considered, and conditions chosen accordingly. (Waentig 2008, 171.)

While there are some especially unstable and potentially dangerous plastics (which will be discussed in section 5.3.2), there are some measures that benefit all (or most) plastics.

- *Monitoring*. Monitoring is vital to preventive conservation of plastics. While some types of plastics may stay in good condition for many years, some can decay dramatically fast, specially once the first signs of deterioration have appeared. Thus, plastic-containing objects should (ideally) be checked once a year for signs of possible degradation, while especially unstable plastics (mentioned in section 5.3.2) should, if possible, be supervised more often. (Shashoua 2008, 9; Standard practice, 2020.)

- *Protection from UV-radiation and light*. As mentioned in section 4.1, UV-radiation remains one of the single most harmful degrading factors for plastics. In addition to that, and while not as harmful as UV, visible light can also cause damage. Therefore, plastics should always be protected from UV-radiation and, whenever possible, be kept away from light sources. For exhibition conditions 50 lux has been suggested as a suitable value, even though 100 – 150 lux may at times be acceptable. (Waentig 2008, 168 – 169; Shashoua 2008, 195; Morgan 1991, 16.)

- *No strong fluctuations in relative humidity (RH) or temperature*. Moisture and higher temperatures can accelerate the degradation of plastics. In most cases, a RH of 40 – 55% ± 5% should be fitting, but plastics prone to degradation by hydrolysis (for example, polyether polyurethane) benefit from lower RH levels (30%), and plastics in which water has been used as a plasticizer (such as casein formaldehyde) should be kept in RH levels above 40%. Temperatures suggested in the literature for storing most plastics are around 15 – 20 °C. (Waentig 2008, 168 – 169; Shashoua 2008, 195.)

- *Adequate ventilation*. While most plastics (with the exception of rubber and polyvinyl chloride, which will be addressed in the next section) benefit from good ventilation, adequate air exchange is critical to plastics that emit harmful gases as part of their aging and degradation processes (cellulose nitrate, cellulose acetate and polyvinyl chloride, which will also be addressed in the next section). These gases do not only accelerate the degradation mechanisms of the objects themselves but can also be harmful to surrounding objects and materials. (Waentig 2008, 169 – 170; Shashoua 2008, 195.)

- *Protection from dust and pollutants*. Dust can have two simultaneous effects on plastic surfaces. On one hand it can degrade the surface by interacting with it

chemically, and on the other hand it can trap moisture, thus accelerating degradation mechanisms linked to it. In addition to that, air pollutants such as sulphur can both corrode and oxidize plastics. (Waentig 2008, 168 – 170; Shashoua 2008,195.) A material that can be useful for protecting objects from dust and water, but still breathes, is Tyvek (What's Tyvek® | Fyber Forma, 2015).

- *Use of inert and acid-free storage materials*. Materials used both in the storage building and for packing should be inert, not absorbent (to avoid drawing out plasticizers) and not emit any gases. Metallic structures covered with an inert coating and products such as Tyvek (which was already mentioned earlier) and Ethafoam are examples of suitable materials (Barber 2014). (Waentig 2008, 167.)

5.3.2 Especially unstable plastics and elastomers

Some materials are especially unstable and thus degrade much faster. It is for this reason that they require special attention and care when it comes to monitoring and storage conditions. Identifying which objects in the collection contain these materials should be high priority. Included in this group are **rubber**, **cellulose nitrate**, **cellulose acetate**, **plasticized polyvinyl chloride** and **polyurethane foam**.

Rubber mostly degrades by oxidation and is one of the few plastic materials that really requires oxygen-free environments, as well as low temperatures to further prevent oxidation (9 – 18 °C). A RH value of ± 50% has also been suggested in the literature. As elastomers, these objects are also prone to deforming, and should be kept in such a way that as little stress as possible is exerted upon their structure. Ideally, this would mean a support in the shape of a negative mold of the object. (Waentig 2008, 201.)

Cellulose nitrate is a plastic that emits harmful gases as part of its degradation process, in this case nitric acid. Acid acts as a catalyst in the degradation process, accelerating it, and should be removed. Efficient ventilation is key, and cellulose nitrate should never be stored in airtight containers. Containers that allow air to flow freely are especially adequate. In addition to that, absorbents can be used to capture the acidic gases. Finally, in order to further slow the aging process, humidity and temperature should be kept low (RH 20 – 30%, 2 – 5 °C). Due to the acidic gas emissions, cellulose nitrate objects can corrode metallic materials, so they should be stored away from them. (Waentig 2008, 214 – 215; Standard practice 2020.)

Cellulose acetate is another plastic that also emits harmful gases as part of its deterioration process. These gases (acetic acid) can also be emitted by other cellulose-based materials and they accelerate cellulose acetate's degradation, hence acid-free materials should be used and wood avoided. Acid-free paper used for storing should be regularly checked and replaced. Generally, the same guidelines as for cellulose nitrate apply (RH 20 – 30%, 2 – 5 °C), but fluctuations are especially harmful to cellulose acetate and should be particularly avoided. (Waentig 2008, 220 – 221; Standard practice 2020.)

In the case of *plasticized polyvinyl chloride*, the main cause for degradation if loss of plasticizer, and preventive conservation aims at slowing this process. This can be achieved by keeping the objects in closed inert containers and away from absorbent materials, in temperatures around 5 °C and a RH value of 20 – 30%. Packing materials should be carefully chosen, since many plasticizers in polyvinyl chloride can melt other plastics. Adequate materials include glass and polyester. (Shashoua 2007, 13 – 14; Waentig 2008, 252 – 253; Standard practice 2020.)

Finally, *polyurethane foam* will be considered. It has already been discussed that both kinds of polyurethane, ether-based and ester-based, are vulnerable to different factors (UV-radiation for polyether polyurethane and hydrolysis for polyester polyurethane). Nevertheless, it is often challenging to identify the type of polyurethane without chemical analysis so, as a rule of thumb, both UV-radiation and humidity should be avoided. This means storage in low temperatures (5 °C, or at least under 20 °C), a RH value of 20 – 30%, and complete darkness while in storage. Oxygen-free environments are also especially beneficial to this material. (Waentig 2008, 311; Standard practice 2020.)

6 Conclusions

In the introduction we mentioned that one of the aspirations of this thesis was to increase awareness of the need to provide plastic and plastic-containing objects in museum collections with the attention they require. A survey into the current state of plastics and plastic-containing objects in Finnish museum collections showed that this situation is consistent with that of other museum collections in Europe and North America, where material information of plastic and plastic-containing objects is often lacking or is not systematically gathered. The reason for this is most often also shared with other museums, where resources are spread thin and are not enough to conduct detailed surveys of collections. Fortunately, the mindset is starting to change and plastics are

beginning to receive some of the attention they are due. On the other hand, and when material information about these objects is gathered, clear issues regarding terminology are apparent, as many different (and sometimes inadequate or ambiguous) terms are used to describe the same material or kind of plastic. This makes the monitoring of plastic and plastic-containing objects in museum collections specially challenging, as a single search word cannot be used to retrieve all plastic-containing objects from the online collection management system.

Detailed documentation was written based on the information gathered during the artist interview and careful examination of *Suonisto* and *Turkis*, which will be stored in the online collection management system of the Espoo Museum of Modern Arts EMMA. Moreover, the information it provides has helped increase the value and understanding around these artworks.

By comparing the lifespan and photographic evidence of these two sculptures to other similar ones created by Nieminen, it was possible to determine that the yellowing linked to the degradation process of *Suonisto* and *Turkis* was indeed faster than that of another similar sculpture (*Läpinäkyvä tarjoilija*). Through analyzing the materials and production techniques of these sculptures and studying the different degradation processes that plastics usually undergo, it was possible to single out the most likely degrading factors. These factors were suspected to be linked to the packing materials and choices implemented in 2006, when the sculptures were packed in (nearly) airtight cardboard boxes, which were shared with the stands that the artist had built for them (despite it being noticed that the paint had not fully dried at the time).

The material these sculptures are made of was recreated in order to conduct artificial aging tests it in the laboratory. Lack of ventilation and the presence of packing cardboard and moist paint were tested by using airtight containers and similar cardboard and paint. The accelerating aging lasted a month in a heat chamber at 60 °C, and VIS spectrometry measurements were taken throughout the process. These measurements proved that all three factors increased the rate of yellowing in the mockup test samples, supporting the idea that the storage materials and choices implemented in 2006 were indeed responsible for their accelerated aging. In addition, the aging tests and material analysis conducted strongly suggested the acrylic-based glue in the 3M Scotch® 550 Transparent tape is the component of the polyblend most sensitive to yellowing during

degradation, most likely linked to the presence of carbonyl (C=O) and unsaturated (C=C) cromophoric groups in its acrylate group.

In order to provide some useful information for museum professionals, general guidelines for preventive conservation of plastics and plastic-containing objects were provided, with a special focus on the most unstable of them: rubber, cellulose nitrate, cellulose acetate, plasticized polyvinyl chloride and polyurethane foam. Since being able to provide these items with suitable storage conditions depends on first identifying them, a useful new tool for identification of plastics was provided. It may also be used by people without prior specialist knowledge of plastics.

I hope this work will be helpful not only by raising awareness of the importance of monitoring and providing suitable storage conditions for plastics in museum collections, but also with identifying and caring for these objects that represent an important part of our cultural heritage.

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Artist interview: INKA NIEMINEN, Apollonkatu, Helsinki, 20.2.2020

This document is written in Finnish, because it is intended for the use of EMMA (Espoo Museum of Modern Art) in their documentation, which is mostly kept in Finnish. The interview was also conducted in Finnish. It includes some information regarding the production technique of Nieminen's tape sculptures, that the artist wishes is not published publicly. These parts of the interview have been deleted from this thesis. They are however included in the file provided to the museum.

1. HAASTATTELUN RAKENTEEN ESITTELY
   Haastattelun alussa esittelin taiteilijalle haastattelun rakennetta, ja kerroin, että hän voi päättää mitkä tiedot lisätään opinnäytetyöhön julkiseksi ja mitkä jäävät vain EMMAan (EMMA - Espoon Modernin taiteen museon) dokumentointiin.

2. AVAINKYSYMYS
   a. **Ane: Kotisivujesi sisällöstä löytyy suurin osin veistoksia ja media-taideteoksia, mutta mistä taiteilijaurasi sai alkunsa? Eli kiinnosti-vatko veistokset heti alusta?**
      Inka: Kun pääsin kuvataideakatemiaan en vielä veistänyt, sillä tekeminen oli siellä aika värikeskeistä. Materiaalit kiinnostivat jo silloin 90-luvulla, mutta silloin käytetiin perusmateriaaleja: puuta, metallia, pronssia, kipsiä ja keramiikka. Keramiikka oli ehkä ainoa materiaali, jonka kanssa oli mahdollista tehdä erilaista. Muiden materiaalien käyttöön (esim. muovin) ei silloin kannustettu, sitä pidettiin kummallisena. Ehkä sen takia veistämisen alku oli niin hidasta, kun työskentely oli niin "tietynlaista" ja havainnointikin oli niin maalauksellista. Tavallaan ääriviivan kanssa työskentely oli perustekemistä, kun maalauksessa voi jonkin verran siirtää missä ääriviiva menee, mutta veistoksessa on vaan päätettävä miten se menee. Ellei tee installaatiota, joka jatkuu kaikkialle. Silloin kun installaatiotaide tuli, se vähän helpotti tekemistä.
      Olen kotoisin Hailuodosta ja käsillä tekeminen on tavallaan aina ollut luontevaa. Ehkä silläkin perusteella valitsin sen, koska ajattelin että joka tapauksessa tulee halu tehdä käsillä, vaikka silloin ei vielä ollut minkään näköistä ajatusta siitä, että mitä se voisi olla. Kuitenkin, koululla meni tosiaan pitkään ennen kuin pääsin tekemään muuta kuin muovailla mallia. Olin ehkä kolmannella tai neljännellä ennen kuin pääsin työstämään omia töitä, eikä ennen sitä tullut edes mieleen tehdä muuta. Oli myös käsillä

tekemistä, mutta siellä oli todella isoja koneita ja tapa opettaa oli niin, että ensin tulee idea ja sitten mennään harjoittelemaan tekniikkaa jollain laitteella: puukoneet, metallityöstökoneet ja kiventyöstökoneet. Eli se ei ollut omalla tavalla tekemistä. Välillä muovailin omia töitä, mutta tuntui siltä, että se jäi kaiken muun rinnalle. Se pikkuhiljaa alkoi kuitenkin muodostumaan, ja silloin kun sai jotain tehtyä, kannustettiin kokeilla omia tapoja tehdä. Oli hidas alku, mutta näin se on monella muillakin.

3. LUOMISPROSESSI

a. Voisitko kertoa vähän enemmän koulutuksestasi? Onko se mielestäsi vaikuttanut uraasi, entä millä tavalla?

Olen käynyt taidekoulua maalta, Vapaata taidekoulua, joka oli suurilta osin maalausta) ja sitten Kuvataideakatemiaa Helsingissä. Koulutus on tietenkin vaikuttanut uraan, ja myös mitä koulutus silloin on ollut, joka on toki sidonnainen siihen aikaan. Tämä kuitenkin tapahtuu nykyäänkin, eikä koulutus on syyllinen siitä mitä myöhemmin tekee.

b. Mistä haet inspiraatiota teoksiin? Seuraako luomisprosessisi jotain tiettyä rakennetta?

Ei ole muuta kuin jatkuvaa kokeilua, ja myös se, että lähtee tekemään ilmaan mitään valmistaa ideaa. Kyllä aika lailla annan myös niiden materiaalien viedä minut sellaiseen suuntaan kuin haluavat, esimerkiksi materiaalin merkityssisällön mukaan, mutta kuitenkin perusajatus on jossain muualla kuin siinä. Inspiraatio tulee tietenkin taiteesta ja ympärillä olevista asioista. Se on kyllä siten suhteessa sitä mitä muutkin tekevät. Kaupungissa inspiraatiolähteiden löytäminen on ehkä vähän helpompaa, välimatkat ovat lyhyempiä, olen instituutiossa missä opetan, joudun sanallistamaan miten asiat tehdään, ja ehkä itsekin omassa työskentelyssä pystyn löytämään trendejä, mistä olen kiinnostunut ja mistä asiat tulevat.

c. Kotisivuiltasi löytyy valikoitu erä erilaisia teoksia. Miten olet valinnut ne?

Ehkä sillä tavalla, että ne ovat valmiita teoksia, ja myös siksi että ne ovat olleet jossain esillä. Ja sitten toki sen takia että ne ovat sellaisia mistä olen itse tykännyt, kun ei kaikkia haluaisi laittaa. Ja ehkä vielä sen perusteella, että millaista kuvamateriaalia niistä löytyy, missä teokset näyttävät siltä miltä niiden on ollut tarkoitus näyttää. En ole erityisesti kiinnostunut

dokumentoinnista, enkä kotisivuistanikaan, niitä ei ole vähäksi aikaa päivitetty (Nieminen nauraa).

d. Teoksissa esiintyy laaja kirjo erilaisia materiaaleja, onko aina ollut mahdollista työstää kyseiset materiaalit itse tai oletko joutunut käyttämään ulkopuolista apua?

En erityisen paljon, sillä suurimman osan olen tehnyt itse, mutta kyllä sitä välillä käytän. Esimerkiksi maalauspalveluita maalausfirmassa ja joitain lakkauksia (juuri niitä teippiteoksia) automaalaamossa. Olen mennyt sinne teippiteoksen kanssa, koska heillä on hyvät laitteet ja ilmanvaihto. Videoteoksissakin olen käyttänyt apua ja ääniasioissa on ollut kaveri auttamassa. Sen lisäksi kaikessa kuvaamisessa ja sellaisessa aina tarvitaan jotain porukkaa, varsinkin kun parissa teoksessa esiinnyn itse. Materiaalien tilauksessakin olen joutunut soittamaan ja lähettämään paljon sähköposteja.

Oletko yleisesti pystynyt ostamaan materiaalit Suomesta?

Joo, olen käyttänyt materiaaleja juuri vähän sen perusteella mitä on löytynyt, ja jos ei ole ollut, olen pyrkinyt tekemään materiaalit itse ja yhdistämään sitä mitä löytyy omalla tavallani.

e. Case Study: oliko *Haute Couture* sarja, mihin teokset *Suonisto* ja *Turkis* kuuluvat, luotu johonkin tiettyyn näyttelyyn tai tilaukseen?

Mäntän kuvataideviikoille, olisiko se ollut vuonna 2004. Silloin ei käytetty jalustoja, teokset laitettiin suoraan lattiaan.

4. MATERIAALIT/TEKNIIKAT/MERKITYS

a. Miten tärkeät käytetyt materiaalit ovat sinulle, minkälaista merkitystä niillä on?

Kyllä niillä on paljon merkitystä ja juuri nyt tuntuu siltä, että koko ajan on enemmän ja enempi, ei pelkästään itselleen, ja ollaan kiinnostuneempia niistä kuin mitä oltiin vielä 10 vuotta sitten. Tavallaan ilmastonmuutoksesta johtuen kaikki tietävät mitä ne materiaalit ovat, mistä ne ovat ja mikä niiden hiilijalanjälki on, ja mietitään mitä ostetaan. Merkitykset ovat nykyään ehkä tärkeämpiä itselle ja myös katsojille, ja sen kautta itsekin valitsen mitä haluan kertoa tietyllä materiaalilla. Onko se esimerkiksi puuta, minkälaista polkua se on tullut, onko se suoraan metsästä tai onko se

sahatavaraa, joka on mennyt läpi prosessin. Luonnonmateriaalien käyttö on toki myös aina ollut kiinnostavaa minulle, mutta nyt se on ehkä vielä kiinnostavampaa ja siihen suhtaudutaan eri lailla kuin vähän aikaa sitten. Se on itselleni sitä mitä olen aina halunnut tehdä, ja nyt se on mahdollista. Ja ehkä mitä sillä voi kertoa, se on merkityksellisempää.

b. Mitä tekee tietystä materiaalista mielenkiintoinen juuri sinulle?

Ehkä se mitä aiemmin mainitsin luonnonmateriaaleista, ja tietenkin miten niitä jossain määrin rinnastaa digitaaliseen työskentelyyn. Jos onnistuu rinnastamaan kiinnostavasti, se rinnastus ja materiaalien yhdistäminen saattaa tuoda toista esiin, ja luonnonmateriaali voi näyttää vielä voimakkaammalta. Ehkä juuri se on kiinnostavaa, että voi yhdistä useampia ja katsoa miten ne toimivat yhdessä.

c. Olet teoksissasi käyttänyt erilaisia muovimateriaaleja, mitä niissä on ollut mielenkiintoista materiaalina?

Alunperiin läpinäkyvyys oli varmaan se, mikä kiinnosti minua eniten, sellainen aineettomuus. Ehkä olisi ollut helpompi käyttää lasia, jos olisin itse pystynyt tekemään, ja se olisi lisäksi ollut nopeampaa. En kuitenkaan koskaan käyttänyt, koska se ei ole sellainen materiaali mitä voi työhuoneella kokeilla. Muovilla pystyy tekemään tosi monta asiaa, se taipuu, kovettuu, ja siinä on tavallaan kaikenlaisia mahdollisuuksia. Mutta aineettomuus ja keveys olivat silti pääsyyt, ja myös siksi, että se on edullinen ja helppo saada. Sekin on usein valinta, että voi mennä työhuoneelle ja käydä matkalla ostamassa sekä eväitä että materiaalit lähikaupasta. Se ettei siitä tee liian vaikea, on tavallaan ideologia: kyllä tästäkin voin sitten tehdä ja katsoa mitä tulee.

d. Kotisivuillasi esiintyvä teipistä tehty vanhin teos on ”7th class” vuodelta 2000. Mistä ja milloin idea käyttää teippiä materiaalina syntyi?

Se lähti jo vuonna 1999 teoksella ”Permanent holiday”. Olin silloin Irlannissa residenssissä syksyn, meitä oli kolme taiteilijaa eri puolelta Eurooppaa ja siellä oli kuvanveistokeskus missä työskenneltiin. Meidän piti tehdä loppunäyttely. Olin alun perin lähtenyt sinne tekemään metallitöitä mutten loppujen lopuksi ollut tarpeeksi kiinnostunut niistä, ja rupesin siellä muovailemaan. Oltiin Irlannissa yhteensä kolme kuukautta ja oli vaikea keksiä

mistä ostaisi materiaalit, ja minkälaiset. Sieltä ei mistään saanut puuta, joka on materiaali mihin olin tottunut, ehkä siksi että heillä ei ole paljon metsiä. Sieltä sai lasikuitua ja metallia, mutten ollut kiinnostunut kumpaakaan niistä, ja piti äkkiä keksiä mitä teen loppunäyttelyyn. Ostin sitten teippiä jostain kaupasta, ja toinen materiaali minkä ostin, oli sellainen kertakäyttöpöytäliina. Pöytäliina oli muovia ja pitsiä. Tein siitä yhden teoksen liiman avulla, joka oli sellainen pitsifiguuri. Ja siinä rupesin myös kehittämään sitä teippitekniikkaa ja se onnistui hyvin, sain siitä hyvää palautetta ja kaikki olivat tosi innoissaan. Sain teoksen valmiiksi just edellisenä päivänä ennen näyttelynavajaisia.

e. Onko materiaalin lyhyt elinikä merkityksellinen teippiteosten tapauksessa?

Ei sillä ole väliä. Teen usein ihmishahmoja, ja haen sillä sellaista ”tapahtumaa”. Kunhan materiaalit kestävät ne kolme viikkoa, eli näyttelyn, ja tietenkin vähän pidemmällekin, sillä ei ole paljon väliä. Siinä on sellainen idea ”tilanteesta”, jonka ei tarvitse loputtomiin kestää.

f. ”7th class” teoksen materiaaleina kotisivuillasi lukee teippiä ja ”classroom”. Miten tärkeä teoksesi ympyröivä tila on sinulle?

Ainakin siinä teoksessa se oli todella tärkeä, kun tila oli vanha peruskouluni ja tilaisuus oli kesänäyttely, missä se pidettiin. Sen takia se oli paikkasidonnainen teos. Ei se toki mikään materiaali ole, mutta tuli silti laitettua. Tila ei aina ole tärkeä, mutta jossain tapauksissa se on. Ja tietenkin, jos teokset tehdään johonkin tiettyyn näyttelyyn, käyn yleisesti katsomassa mihin ne tulevat.

g. Kotisivuiltasi löytyy teipistä tehtyjä teoksia ajalta 2000 – 2004, mutta miten pitkään olet käyttänyt teippiä materiaalina, entä oletko mielestäsi käsitellyt aiheen jo loppuun?

Joo, kyllä se on loppuun käsitelty. Se oli periodi, minkä silloin Irlannissa aloitin ja Helsingissä pidin joitain näyttelyitä, mutta jossain vaiheessa kyllä kyllästyin siihen. Palaute minkä sain Irlannissa, oli tosi hyvä, mutta Suomessa teippiteoksiani pidettiin vähän kummallisina, oltiin sitä mieltä, että tämä ei ole peruskuvanveistomateriaali. Kyllä muistan, että siitä sai kuulla että ”Miten sä oot päättynyt tuollaiseen?”. Lehtijuttuja en muista niin hyvin,

mutta oli kuitenkin varmaan jotain jostain näyttelystä. Muistan että joku sanoi että ”Niin hyvä tekijä, ja lähtee tekemään tuollaista kuvanveistoa”. Oltiin sitä mieltä, ettei se ollut mitään oikeaa. Kyllästyin itse asiassa myös hajuun, sen liiman hajuun. Ei minua mitenkään haitannut, jos joku oli sitä mieltä, ettei tämä ole kauhean hyvä materiaali, mutten jaksanut hajua. Rupesin käyttämään kaasumaskia, mutta työskentely kaasumaskin kanssa oli raskasta, ja joutuu silti sitä haistelemaan koko ajan. Eli tuo *Haute Couture* oli varmaan viimeinen teippiteos, sen jälkeen en niitä tehnyt enää.

h. Teippiteoksissasi esiintyy suurin osin kirkasta teippiä, mitä teippiä se on, entä miksi valitsit juuri sen?

Käytin Scotch® -teippiä (3M Scotch® 550 Transparent) koska liima oli siinä parasta, eikä siinä ollut sellaista kuplaa. Joissain teipeissä oli sellaista ilmakuplaa, ja kun sitä laitettiin monta kerrosta, lopputulos oli vähän samea. Eli se valikoitui sillä perusteella, että se oli kirkkainta.

i. Miten tämän materiaalin käsittelytekniikkasi syntyi, entä minkälaisiin vaikeuksiin olet matkalla kohdannut?

Tekniikka syntyy niin kuin mainitsin vähän sattumalta, halusin sellaista aineettomuutta ja vähän sellaista ”valokuvan tyypistä”, jotta veistos vaikuttaisi jollain tavallaan siltä, ettei ole niin todellinen. Silloin kun materiaalilla on paljon painoa ja massaa, sen huomaa, ja halusin toimia painon kanssa. Saada sen näyttämään siltä, että mikä siellä on ei ole niin todellista, ja yrittää häivyttää figuurin olemassaoloa. Sen kanssa yritin työskennellä. Jälkeenpäin olen ajatellut, että sitä olisi voinut tehdä videolla, taikka maalauksella. Sitä mitä yritin, ei ehkä parhaimmillaan toimi veistoksessa. Se voi toimia paremmin silloin, kun ottaa kuvan teoksesta, tilassa ei aina toimi samalla tavalla. Valaistus on todella tärkeä, jotta siitä tulee sellainen kuin haluaa. Hirveän monta vuotta yritin sellaista, mikä olisi ehkä voinut tehdä suoraan videolla. Jääräpäisyyttä ehkä, etten suostunut vaihtamaan välinettä. Kaikkea ei pysty tehdä yhdellä tavalla. Nykyiset opiskelija toki osaavat tehdä sen, mutta kun itselläni on eri kuvanveistokoulutausta, pysyin väkisin siinä. Jos olisin ottanut videokuvan se olisi ollut siinä, tosi kauan kesti ennen kuin tajusin, mutta tuli vähän kokeiltua.

Materiaali oli vaikeaa, koska se oli heti hieno, mutta silloin kun pintajännite häipyy ja pikkuhiljaa lässähtää, tosi nopeasti alkaa mennä sen muoto siitä. Eikä edes pelkästään, että muoto häipyy, mutta koko pinta ei enää ole niin tiukka. Se vaan antaa periksi, siinä on vähän jännitettä pinnassa ja tiukkuus menee tosi nopeasti, enkä tykännyt siitä yhtään, sillä se ei enää ole ”skarppi”. Ja se meni sellaiseksi jo muutamassa viikossa. Se joustaa, eikä se enää palaudu siihen. Jännite syntyy teippauksessa. Silloin kun se on paikalla, se venyy ja antaa periksi, vaikka siihen laitettaisiin minkälaisia tukia tai vaikka sille olisi mitään tehty, se ei enää ole sellaista tiukkuutta, mikä siinä aluksi oli. Ei se myöskään kuljetusta oikein kestänyt ja oli herkkä lämpötilamuutoksille. Yritin lakalla ja kaikenlaisilla menetelmillä pitää niitä sellaisina kuin halusin, mutta se työmäärä suhteessa siihen kaikkeen oli vähän pettymys, mitä se kesti ja mitä sillä pystyy sitten esittämään. Sillä tekniikalla jännite oli liian suuri.

j. Voisitko kertoa luomastasi tekniikasta tarkemmin, eli miten tällainen teos syntyy?

[Tarkkoja valmistustekniikkatietoja luettavissa vain EMMA museolle laaditussa versiossa]

k. Oletko joskus törmännyt tai kuullut samankaltaisista teoksista?

Kyllä olen jossain nähnyt, että joku muukin on tehnyt samanlaista. Se oli siihen aikaan, kun itse valmistin omat, joku oli tehnyt jonkun nukkeen. En muista nimeä, mutta se oli jossain ulkomailla. Samalla tekniikalla olen joskus myös tehnyt huonekaluja.

l. Valo esiintyy joissain teoksissasi projisointina, mutta sitä voisi myös ajatella kirkkaiden teippiveistosten läpi kulkevana osatekijänä. Ajatteletko valoa veistoksiisi kuuluvana materiaalina?

Joo, onhan ne tarkkaan valaistu aina. Valolla ja sen suunnalla on tosi paljon vaikutusta siihen, miltä teos näyttää: tuleeko valo läpi tai heijastuuko myös pinnasta. Valonheijastuskyky on näiden teosten tapauksessa aina ollut tärkeä. Eli joo, valoa voisi teippiteosten tapauksessa ajatella materiaalina.

m. Case study: Ensimmäisessä sähköpostissasi kerroit siitä, että tämä teippi on muuttunut paljon näiden teosten valmistuksen jälkeen, voisitko kertoa, miten se on muuttunut, entä milloin huomasit muuton?

Ei sitä kauan mennyt, kun olin itse lopettanut, ehkä noin viisi vuotta (2010). Olin silloin opettamassa, tehtiin joitain muovailufiguureja ja jotkut opiskelijat eivät halunneet tehdä valua kipsistä. Sanoin että jos haluaa tehdä nopeasti voi myös tehdä tällaisella tekniikalla. Ostettiin niitä samoja teippejä sinne, ja huomasin että kun annoin ohjeita, antamani kerrosmäärä ei riittänyt enää, ei pitänyt olenkaan. Siitä tulee pehmeämpää ja ohuempaa. Sitä pitää laittaa melkein tuplan verran kerroksi, jotta rupeisi olemaan samanlaista.

n. Case study: näissä teoksissa esiintyy myös muutakin teippiä, miksi päätit käyttää muita teippejä yksityiskohtien tekemiseen, esimerkiksi maalin sijaan? Muistatko mitä teippiä ne ovat?

Ehkä halusin pysyä siinä samassa. Tykkäsin siitä ruskeasta pakkausteipistä erityisesti, siitä löytyy aika hienoja sävyjä kun eivät kaikki ole samoja. Ja ehkä halusin niiden kautta tehdä sellaista, joka sopii siihen. Maaliakin käytin sitten joissain teoksissa *(Miranol)*, ja se toimii ihan hyvin siinä, mutten saanut sitä maalauksellisuutta mitä halusin, ja vaihdoin takaisin teippiin. Toisaalta molemmat toimivat tavallaan. Se on sitä kokeilua ja teipillä sain sellaista piirustusjälkeä mistä tykkäsin. Käytin Tescon ja Scotch®in teippiä, kun ei siellä (Irlannissa) paljon muuta ollut, ja valitsin niitä värin mukaan.

o. Case study: näissä teoksissa näkyy metallilankaa, mikä sen tarkoitus/funktio on?

Se oli vaan jotain rautalankaa mitä löytyi. Funktio oli pitää muotoa, kun siinä on sellaista ongelmaa, että jos muoto on vähän isompi se meinaa mennä vähän kasaan. Joihin kohtiin laitoin sitten sitä.

[Tarkkoja valmistustekniikkatietoja luettavissa vain EMMA museolle laaditussa versiossa]

p. **Case study: nämä hahmot näyttäisivät ”leijuvan” noin 10 sentin korkeudella, on tämä tärkeä teosten merkityksessä? Miten akryyliputki on kiinnitetty jalkoihin?**

Hahmot leijuvat sen takia että se korostaa materiaalin aineettomuutta. Akryyliputket on kiinnitetty figuurien jalkoihin Scotch Strong teipillä.

q. **Case study: vanhan dokumentoinnin mukaan teokset on päällystetty venelakalla, voisitko kertoa miksi? Muistatko mitä lakkaa se on?**

Minulla on koko ajan sellaista mielikuvitusta, että siellä luki Oksalakka, ja sehän ei ole venelakkaa. Mutta jos se oli venelakka, se oli varmasti jotain *Hempeliä*. On vaikea olla varma siitä, että mitä käytin, mutta kun tyhjensin työhuonetta, muistan että heitin pois *Hempelin* lakkapurkkeja. *Hempel* on semmoinen venemerkki, niitä piti viedä ongelmajätteeseen. Käytin sitä koska ajattelin että se kestäisi valoa paremmin (siinä on UV-suoja), ja varmaan ajattelin myöskin, että muoto pysyisi myös paremmin.

r. **Case study: Silloin kun Saastamoisen Säätiö osti nämä teokset, valmistit niille jalustoja. Sähköpostissa kerroit, että maalipinta ei meinannut kuivua, mistä luulet, että se on voinut johtua? Muistatko mitä maalia se oli?**

Se oli Tikkurilan *Betoluxia*, siinä on pitkä kuivumisaika. Sovittiin Saastamoisen Säätiön kanssa joku päivä noutoon ja olin laskenut, että neljä päivää riittää, muttei se välttämättä riitä. Olen käyttänyt sitä maalia puun kanssa, mutta jalustat ovat metallisia, ja laitoin sitä maalia vielä niin hirveän paksusti. Eli kuivumisaika oli pidempi kuin mitä ajattelin. Soitin säätiölle ja kysyin voiko olla näin, eikä se ollut heille ongelma.

5. KONTEKSTI

a. **Tällä hetkellä toimit Kuvataideakatemian Kuvanveiston opetusohjelman lehtorina missä pidät mm. materiaalien käyttöön perustuvaa kurssia, ja opetat myöskin ”Miten idea materialisoituu?” nimistä kurssia Aallon Uwas -koulutusohjelmassa. Millä tavalla materiaaleihin perustuvien kurssien opettaminen on vaikuttanut suhteeseesi teoksissasi käyttämääsi materiaaleihin?**

Uwas on Aalto Artsin ”University Wide Art Studies”, kaikille Aallon korkeakouluopiskelijoille tarkoitettua taideopetusta. Totta kai se on tuonut uusia ajatuksia, opiskelijat vaihtuvat joka vuosi, ja on kiinnostavaa seurata miten he suhtautuvat materiaaleihin: mitä he haluavat, mistä he haluavat tehdä ja mitä he ajattelevat niistä. Aallossa on taideala ja myös muitakin aloja, tekniikka ja muita, opiskelijat ovat eri puolelta ja sekin on sillä tavalla kiinnostavaa.

Onko se tuonut uusia ideoita materiaaleista mitä voisit käyttää?

Ei se sillä lailla, se on yleensä mennyt toiseen suuntaan. Mutta ehkä sillä tavalla, että kun on paikan päällä, voi ostaa koululle kaikenlaisia uusia materiaaleja ja voi sitten itsekin ohimennen niitä kokeilla. Mutta kyllä se kuitenkin aina sitten johonkin vie, se että pyörii niiden asioiden kanssa myös palkkatöissä. Joskus oma tekeminen rajautuu, kun ei itse ehdi käydä ostamassa kaikkea mitä tulee mieleen, eikä ole rahaa kaikkeen, eli siinä on se hyvä puoli, että on ne kaikki mahdolliset välineet. Myös se suhde kaikkeen siihen teknologiaan mitä Aallossa on, vaikken itse varsinaisesti käytä sitä teknologia hirveästi, mutta kyllä sitä peilaa koko ajan, mitä sillä voisi saavuttaa. En valitettavasti edes tiedä kaikkia workshopeja mitä siellä on. Eli on vaikea sanoa, miten se on konkreettisesti vaikuttanut, mutta on se tietenkin varmasti (vaikuttanut).

b. Minkälainen taideopetus oli aikanasi, entä millä tavalla se on voinut vaikuttaa taiteilijauraasi?

Suomessa on aina käytetty puuta materiaalina, ja se on sillä lailla vaikuttanut tekemiseeni, kun sitä on ollut helppo työstää ja saada.

Opetettiinko silloin eri tavalla?

Tavallaan, ja tavallaan ei. Kuvanveistossa edelleenkin on niin, ettei mitään valmista anneta, sen pitäisi tulla opiskelijan omista lähtökohdistaan, vaikka ehkä jossain määrin opiskelijat toivoisivat, että sitä olisi enempi. Opiskelija rakentaa itse oman opintopolun. Totta kai heillä on nykyään paljon enemmän mahdollisuuksia, kun he voivat valita kursseja kaikista taideyliopiston opetuksesta, onhan se laajempaa. Meillä oli vähemmän mahdollisuuksia, tehtiin niitä perusasioita enemmän. Vastaukset en annettu siihen, että millaista taide on, miten sen oppii. Sillä tavalla vapaata se on edelleen. Tietenkin tekeminen on internetin ja teknologisen ajattelun kautta myös muuttunut tosi paljon, silloin kun me opiskeltiin me ei

nähty mitään, ei tiedetty mitä maailmassa tehdään. Nyt me tiedetään kyllä. Ja nyt kun on myös digitaalinen ajattelu, koko prosessi on erilainen. Siellä ollaan auki moneen suuntaan, ei lähdetä vain yhtä linjaa vaan samalla kun työskennellään, otetaan muualtakin sitä tekemistä.

c. **Olit ymmärtääkseni myös vaihdossa Prahassa ja residenssissä Irlannissa. Minkä takia päätit lähteä juuri noihin paikkoihin, entä onko se jossain muodossa ollut näkyvillä taiteessasi?**
Irlannin redisenssi ei suoraan tuonut niitä teippiteoksia. Oli ehkä enemmän sitä, ettei siellä ollut niitä asioita mihin olin tottunut, muttei siellä ollut mitään esimerkkejä. Mutta ehkä se vaikutti sillä tavalla, että siellä tehtiin vähän laajasti, käytettiin helpommin vähän kaikkea, mitä Suomessa ei vielä ollut. Eli siellä saattoi olla se, että pystyi rohkeammin lähtemään kaikkeen sellaiseen mikä mieleen tuli. Prahaan lähdin, koska ajattelin, että se olisi sellainen todella hieno kaupunki, oli sellaista mielikuvaa siitä, että siellä on aivan mahtavaa. Sieltä ei kuitenkaan tullut mitään varsinaisesti uutta, se oli sitä mallin tekemistä, enkä tiedä onko se paljon vaikuttanut.

d. **Case study: Liittyvätkö mielestäsi nämä teokset johonkin tiettyyn valmistusaikansa taidesuuntaukseen tai ilmiöön?**
Ei ne liity mitenkään mihinkään aikansa ilmiöön Suomessa, ne syntyivät koska oli mielenkiintoa ottaa kuvanveistoon uutta esitystapaa ja laajentaa materiaalien käyttöä.

6. TEOKSEN MERKITYKSEN VÄLITTYMINEN/TEOSTEN VANHENEMINEN

a. **Mitä haet erityisesti teoksissasi? Eli minkälaisia reaktioita haet katsojilta, entä minkälaisia mekanismeja käytät sen saavuttamiseksi? Olen esimerkiksi huomannut, että teoksissasi yhdistät usein orgaanisia aiheita ja synteettisiä materiaaleja (muoveja), tai orgaanisia materiaaleja ja medialaiteita.**
Se on juuri sitä, että sillä tavalla saisin vähän paremmin esiin sitä luonnonmateriaalia, kun niissä on usein sellaista, ettei ole kiiltoa tai eivät heijasta värejä (esim. savi tai puu), ja siihen saa sitä valoa mukaan. Ja sitten haen ehkä myös sellaista ”tilannetta”, mitä voi esimerkiksi liikkeen avulla lähteä esittämään. Ehkä joissain teoksissa olen myös ajatellut läsnäoloa.

Teoksissa, missä on henkilö mahdollisesti siinä, kun katsoja katsoo teosta siellä, on myös joku, joka katsoo takaisin, siellä on vuorovaikutus.

b. Case study: minkälaista merkitystä näillä teoksilla on? Liittyykö niihin joku tietty viesti tai tunne?

Teoksessa *Turkis* on tavallaan vähän sitä ihmisen ja eläimen kohtaamista. Siinä on ihmisen figuuri, joka on mallinukke, eli ei tavallaan kukaan konkreettinen henkilö. Se on kuva ihmisestä. Ja siinä on sitten sitä karvoitusta, mikä tulee siitä eläimestä. Siinä on sitten *Suonisto*. Sen kohdalla olen tavallaan ehkä myös ajatellut sellaista reittiä mitä ihmisessä on, verisuoniverkostoa. Ja sitten on se *Puunsyy*, joka on vähän sitä samaa, eli puun tai luonnon ja ihmisen kohtaamista.

Entä sarjana, kaikki yhdessä?

Siinä on sitä esittämistapa, että se on tavallaan muotinäytös, eli ehkä siinä on myös jonkun tilanteen esittäminen mukana.

c. Materiaalit muuttuvat vanhentuessaan, ja jotkut materiaalit ovat erityisen herkkiä. Vaikuttavatko erilaisten materiaalien vanhenemisominaisuudet materiaalivalintoihisi?

Kyllä sillä on nykyään merkitystä, silloin aikaisemmin ei valittanut siitä paljon yhtään. Yritän kyllä myös ajatella konservaattorit (nauraa). Aina toivon, että materiaalit kestäisivät, ja se on nykyään vähän helpompaa, kun on paljon enemmän tietoa niistä, ja sitä pystyy helposti hakemaan internetin avulla. Ennen, kun yritti soitella ja kysyä, kukaan ei sanonut mitään eikä vastannut. Nykyään pystyn myöskin kysymään Aaltostakin joiltain ihmisiltä, kun he tietävät tosi pienistäkin asioista, ja sekin helpottaa asiat.

d. Miten paljon ikääntyminen voi mielestäsi muuttaa taiteteosten merkitystä?

Se kyllä riippuu materiaalista. Jos kyse on luonnonmateriaalista, muutos on jotenkin luonnollista, mutta noissa muoveissa se ei sitten ole, sitä ei lähinnä voi ennakoida mitenkään. Eikä se välttämättä pysyy muutoksen jälkeen kiinnostavana, koska ehkä juuri se syy minkä takia olen valinnut materiaalin, on kadonnut. Se voi kyllä joissain tapauksissa olla toisin, että muutoksenkin jälkeen materiaali (muovi) pysyy kiinnostavana, mutta useimmiten ei se näin ole.

e. **Sovitko ostajien (museot, säätiöt, jne.) kanssa myynnin aikana milloin teosta ei saisi enää esittää? Esimerkiksi jos kyseessä on vanhentumiseen liittyviä muutoksia.**
En kyllä sovi, eikä sitä on kysyttykään.

7. VAURIOITUMINEN

a. **Case study: kun lähetin kuvan teostesi nykyisestä kunnosta vaikutit yllättyneeltä, mitä tuli mieleen, kun näit kuvan?**
Kyllä olin siitä vähän yllättynyt, kun ne näyttivät yhtä huonolta kuin omassa varastossa ollut (*Puunsyy*). Aina ajattelee, että se on oma vika, kun teos menee huonoon kuntoon, ettei jaksanut varastoida oikein, mutta nämä olivat siellä EMMAssa ja hyvin varastoituneet, ja olivat kuitenkin menneet noin pahaan kuntoon.

b. **Case study: Voisitko kertoa samaan *Haute Couture* sarjaan kuuluvasta kolmannesta hahmosta *Puunsyy*, joka on ollut varastoituna ateljeessasi?**
Se oli käärittynä paperiin ja kuplamuoviin, ja on ollut kuumassa ja suorassa auringonvalossa. Vallilan ateljeessa on varmaan ollut 45 °C kuumimpina päivinä. Se on tasaisesti kellastunut. Se oli ehkä alle 10 vuotta kohtalaisessa kunnossa, mutta silloin kun kellastuminen alkoi, lähti sitten nopeasti.
EMMAn kuvaaja ehtii kuvata teokset vuonna 2009 ja ne vaikuttivat todella keltaisilta jo silloin. Mitäs mieltä olet tästä?
Mielestäni *Puunsyy* ei kellastunut niin nopeasti.

c. **Olet vuosien varrella valmistanut useita teoksia muovista, oletko itse huomannut muutoksia kunnoissa tai saanut palautetta asiakkailta?**
Yksityisille en ole myynyt muoviteoksia, joten en saanut palautetta heiltä. Lähinnä muoviteokset ovat olleet silikonia, ne kestävät vähän paremmin. On yksi sellainen muoviteos, myös silikonia, jonka olen monta kertaa meinannut heittää roskiin ja yksi kaveri ottaa sen aina sieltä. Se ei mene miksikään, mutta se on musta, niin siinä ei näy mahdollista kellastumista. Rakenne on myös pysynyt hyvin.

d. Miten kellastuminen vaikuttaa teippiteoksesi merkitykseen?

Ei se minua paljon haita, mutta kyllä se vaikuttaa niiden merkitykseen, kun niistä on tullut sellaiset ”vanhukset”.

e. Onko mielestäsi sellainen vaihe, kun muutokset ovat muuttaneet teoksesi merkityksen niin, että sitä ei saisi enää esittää?

Joo, kyllä se on aika rajalla, että voiko tuommoisia nyt enää laittaa esille. Näiden teosten (*Haute Couture*) kunto on aika huono, mielellään niitä ei mihinkään ole enää. Saastamoisen Säätiön ostaja silloin, Leena Peltola, joka oli noin 80-vuotias, kävi ostamassa *Haute Couture* -sarjan hahmot *Turkis* ja *Suonisto*, ja kerroin hänelle ettei voi tietää miten teokset tulevat kestämään, sillä niissä on teippiä materiaalina. Hänen mielipiteensä oli sellainen, että voidaan ostaa teoksia, jotka eivät pysy samana tai tuhoutuvat. Se oli silloin jo aika radikaalia ajattelua, ettei kaikkien teosten tarvitse kestää. Teippiteosten suhteeseenkin oli eri ajattelutapa kuin muilla, kun hän oli sitä mieltä että ”Kyllä taide voi myös olla tällaista”.

f. Case study: minkälaisia muutoksia olisivat näiden teosten tapauksessa hyväksyttäviä?

Tietenkin omiin vanhoihin teoksiin suhtautuu jo lähtökohtaisesti vähän negatiivisesti. Kellastuminen on kyllä tapauskohtaista, sillä se voi välillä näyttää tosi hyvältä, ja tavallaan se esittää myös ikääntymistä. Kuitenkin näiden teosten tapauksessa, ne eivät enää esitä sitä mitä ne esittivät silloin. Kyllä niitä voisi laittaa esille, jos on sellainen konsepti tai idea mihin ne kuuluisivat, esimerkiksi hajoaminen. Silloin se ei haittaisi, vaikka olisivat kuin hajonneet.

g. Case study: jotkut saumat ovat tällä hetkellä enemmän ”auki” muihin verrattuna. Muistatko olivatko ne jo tässä muodossa valmistuksen aikana?

Ei ne olleet niin auki ennen. Ei voi tarkkaan tietää, mutta on todennäköisesti tapahtunut valmistuksen jälkeen.

8. KONSERVOINTI/RESTAUROINTI: taiteilijalle kerrottiin ensin vähän konservoinnista/restauroinnista ja niiden tavoitteista.

a. **Mitä mieltä olet aktiivisista konservointitoimenpiteistä? Näiden teosten tapauksessa on hyvin todennäköistä, ettei sellaisia voi suorittaa, mutta haluaisitko mieluummin, että teoksesi korjataan silloin kun vaurioita syntyy, jos ne ovat korjattavissa?**
Kyllä sekin on tapauskohtaista. Niitä voi yrittää korjata, jos se on mahdollista, mutta se riippuu siitä, että miltä ne sitten näyttävät.

b. **Entä mitä mieltä olet osien mahdollisesta korvaamisesta eri materiaalilla, jos ero ei ole paljain silmin huomattavissa?**
Ei se sitten haittaa, tai ei tule mieleen, että se haittaisi.

c. **Edellisten kysymyksien perusteella, minkälaisia rajoituksia tai toiveita sinulla olisi konservoinnin suhteeseen?**
Ainakin haluaisin että siitä kysyttäisiin ja oltaisiin yhteyksissä: miten ja mitä teoksille tehdään. Se tietenkin riippuu materiaaleista, ja voihan olla, että jollekulle en haluaisi, että tehdään mitään, mutta jollekulle toiselle haluan, että tehdään. Jos mietin sitä savihommaa (uusi tekniikka minkä taiteilija esitti, kun kävin ateljeessaan), todennäköisesti toive olisi, että sille ei tehtäisi mitään, jos joskus esitän niitä tai päättyvät johonkin kokoelmaan. Mutta tuon muovin kanssa ehkä tietenkin toivoisin, että tehtäisiin jotain, kun ikääntyminen on erilaista. Ylipäätään toivoisin, että otettaisiin yhteyttä minuun ja katsottaisiin mahdollisuudet yhdessä. Ja tavallaan myös taiteilija voi myös pystyä keksimään siihen jonkun ratkaisun nopeammin, ettei tehdä turhaa työtä etsien jotain, joka ei oikein käy. Saattaa olla, että taiteilijalla on olemassa ratkaisut jo heti, ja tietoa, mitä konservaattorilla ei ole.

Documentation of the sculpture SSKO:1971 *Suonisto*

KOKOELMATEOSTEN
DOKUMENTOINTI: VEISTOKSET

ESPOO MUSEUM OF MODERN ART

PERUSTIEDOT

TAITEILIJA Nieminen, Inka		INV.NRO SSKO:1971
KOHDE “Suonisto” (Sarjasta “Haute Couture”)	EDITIO	AJOITUS 2004
VALMISTUKSEEN OSALLISTUNEET Nieminen, Inka		
TEKNIIKAT Muovailu, teippaus, sulatus, leikkaus		
MATERIAALIT JA OSAT 3M Scotch® 550 Transparent teippiä (leveys 12 mm ja 19 mm, muovikalvo on polypropeenia ja liima akryylipohjainen), polyeteenikelmua, ruskeaa pakkausteippiä, punaista muovista teippiä, rautalankaa, PMMA-putket jaloissa, Hempel-venelakkaa (taiteilija ei ole täysin varma merkistä). Veistokseen kuuluu maalattu metallinen jalusta.		
MAKSIIMIMITAT JA PAINO Noin 160 cm x 60 cm x 23 cm	MUUT MITAT Jalusta: Vaaleanharmaa metallilaatta (50 cm x 50 cm x 0,5 cm) + 10 cm tappi (halkaisija 15 mm)	
SIGNEERAUS Ei	MERKINNÄT Ei	LEIMAT Ei
SIJOITUSPAIKKA		
HANKINTATIEDOT Hankinta SSKO 2006 Inka Nieminen Viitenumero: 2006.5		
SUOJAUS, ESILLEPANOSUOSITUS JA JALUSTA Veistokseen kuuluu taiteilijan valmistama Tikkurilan Betolux:illa maalattu vaaleanharmaa metallinen jalusta, sen voi käyttää esillepanoa varten. Veistos on herkkä, ja se täytyy käsitellä varoen, molemmin käsin vyötäröstä tai tukevasta kohdasta kiinni pitäen. Veistos ja jalusta siirrettävä erikseen.		
OLOSUHDEVAATIMUKSET UV-valosta ja pölystä suojattuna, paikassa missä ilma pääsee vaihtumaan.		
PAKKAAMINEN JA SÄILYTYS UV-valosta ja pölystä suojattuna, muttei suljetussa laatikossa. Sopiva laatikko on esimerkiksi runko, joka on päällystetty Tybek:illa, jotta ilma pääsee vaihtumaan. Käytettävä happovapaita materiaaleja.		

KOKOELMATEOSTEN
DOKUMENTOINTI: VEISTOKSET

ESPOO MUSEUM OF MODERN ART

PERUSTIEDOT

KUVAILU JA RAKENNE
3M Scotch® 550 Transparent teippiä ja polyeteenikelmua sulattamalla valmistettu kirkas ja ontto naishahmo, joka esittää mallinukkea. Hiukset on päällystetty ruskealla pakkausteipillä, ja hahmon ihon päälle on tehty suoniverkosto ohueksi leikatulla punaisella muovisella teipillä. Hahmon sisälle on rakennettu runko kahdesta eri rautalangasta, joista toinen on tumma ja toinen vaalea. Veistoksen pinta on oletettavasti lakattu Hempel-venelakalla (taiteilija ei ole täysin varma merkistä).

[VAIN EMMALLE]
Valmistustekniikka: Hahmo on valmistettu savesta muovaillun veistoksen päälle, joka on käärityn kahdella kerroksella polyeteenikelmua. Kelmun päälle on laitettu noin 5 kerrosta 3M Scotch® 550 Transparent teippiä. Teippikerrokset on sulatettu yhteen kuumailmapuhaltimella, jonka jälkeen sulatettu kerros on avattu mattoveitsellä, samalla idealla kuin kipsiteokset tehdään. Kuoren osat on laitettu yhteen lisäämällä sitä samaa kirkasta teippiä. Leveimmille kohdille on lisätty sisälle rautalankaa tueksi, ja jalkoihin polymetyylimetakrylaatti (PMMA) -putkia esillepanoa varten. Venelakka on lisätty lopussa, yksityiskohtien tekemisen jälkeen.

Teoksen merkitys: ”Haute Couture” sarjassa taiteilija pyrkii esittämään ”tilanteen” muotinäytöksen muodossa, missä hahmot eivät edusta mitään tiettyä henkilöä, vaan ne edustavat ihmisiä tai ihmiskuntaa. Teoksessa ”Suonisto” verisuoniverkko symboloi ihmisten sisäistä reittiä.

TAUSTATIEDOT
Veistos kuuluu sarjaan “Haute Couture”, mihin kuuluvat myös kaksi muuta teosta: ”Turkis” (SSKO:1972) ja ”Puunsyy” (taiteilijan omistuksessa). Sarja esitettiin Mäntän Kuvataideviikoilla vuonna 2004 (6.6 – 15.8), jonka kuraattorina toimi Kari Kenetti.

PÄIVÄYS	KONSERVAATTORI
11.3.2020	Ane Orue-Etxebarria

KOKOELMATEOSTEN
DOKUMENTOINTI: VEISTOKSET

ESPOO MUSEUM OF MODERN ART

KUNTO

INV.NRO
SSKO:1971

PVM.	YLEISKUNTO	PVM.	YLEISKUNTO
2/2006 11/2019	Tyydyttävää Huono		
PÄIVÄYS JA KONSERVAATTORI	YLEISKUNTO	PVM.	KONSERVOITU (tarkemmat tiedot päiväkirjassa)
22.2.2006 Raili Laakso	Tyydyttävää. - halkeama vasemman rinnan ja olkapään välissä, noin 4 cm - teos on hieman pölyinen - vasen polvi on ulkosivulta painunut hieman (merkitty kuvaan)		
4.11.2019 Ane Orue-Etxebarria	Huono, todella kellastunut		

KOKOELMATEOSTEN
DOKUMENTOINTI: VEISTOKSET

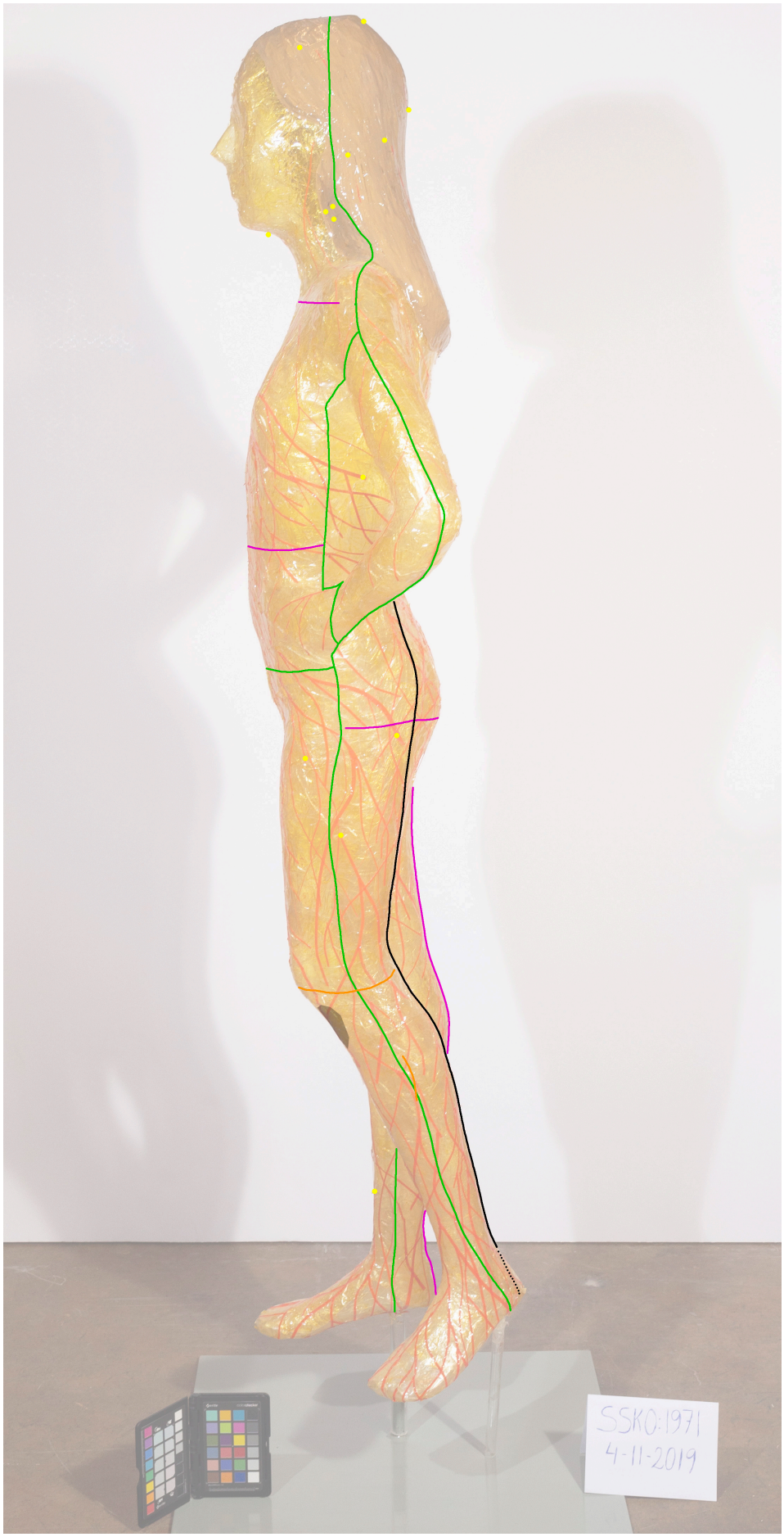
PÄIVÄKIRJA

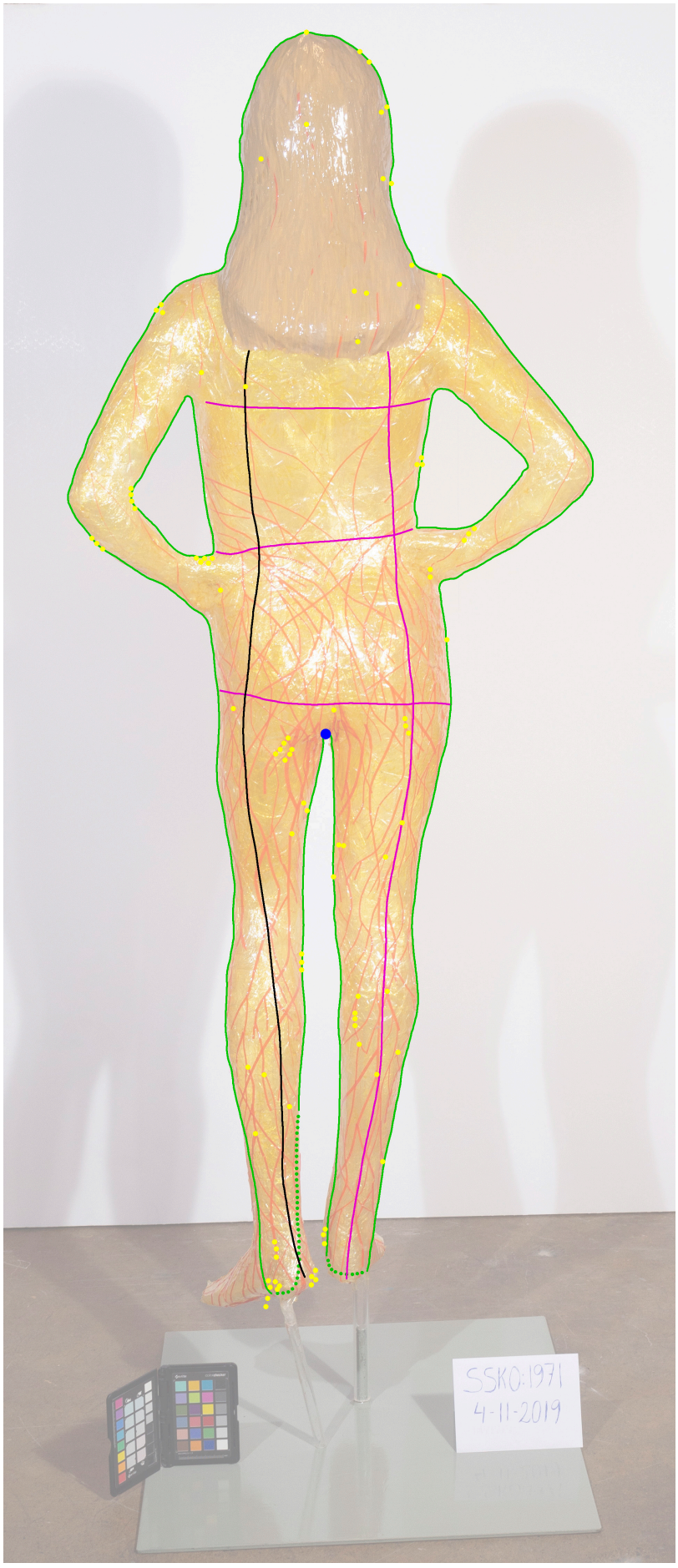
ESPOO MUSEUM OF MODERN ART

INV. NRO
SSKO:1971

PÄIVÄYS JA KONSERVAATTORI	TOIMENPITEET
22-24.2.2006 Raili Laakso	Dokumentointi, kuntotarkastus ja digikuvaus
4.11.2019-11.3.2020 Ane Orue-Etxebarria	Dokumentointi, kuntotarkastus ja digikuvaus


KUNTOKARTOITUS 11/2019
- saumat
- sauma auki
- tumma lanka
- vaalea lanka
- lommo
- halkeama
- reikä
- teippi koholla
SSKO:1971
4-11-2019


SSKO:1971
4-11-2019


SSKO:1971
4-11-2019


SSKO:1971
4-11-2019

Documentation of the sculpture SSKO:1972 *Turkis*

KOKOELMATEOSTEN
DOKUMENTOINTI: VEISTOKSET

EMMA ESPOO MUSEUM OF MODERN ART

PERUSTIEDOT

TAITEILIJA Nieminen, Inka		INV.NRO SSKO:1972
KOHDE "Turkis" (Sarjasta "Haute Couture")	EDITIO	AJOITUS 2004
VALMISTUKSEEN OSALLISTUNEET Nieminen, Inka		
TEKNIIKAT Muovailu, teippaus, sulatus, leikkaus		
MATERIAALIT JA OSAT 3M Scotch® 550 Transparent teippiä (leveys 12 mm ja 19 mm, muovikalvo on polypropeenia ja liima akryylipohjainen), polyeteenikelmua, ruskeaa pakkausteippiä, vahvistettua kuituteippiä, rautalankaa, PMMA-putket jaloissa, Hempel-venelakkaa (taiteilija ei ole täysin varma merkistä). Veistokseen kuuluu maalattu metallinen jalusta.		
MAKSIIMIMITAT JA PAINO Noin 160 cm x 55 cm x 23 cm	MUUT MITAT Jalusta: Vaaleanharmaa metallilaatta (50 cm x 50 cm x 0,5 cm) + 10 cm tappi (halkaisija 15 mm)	
SIGNEERAUS Ei	MERKINNÄT Ei	LEIMAT Ei
SIJOITUSPAIKKA		
HANKINTATIEDOT Hankinta SSKO 2006 Inka Nieminen Viitenumero: 2006.5		
SUOJAUS, ESILLEPANOSUOSITUS JA JALUSTA Veistokseen kuuluu taiteilijan valmistama Tikkurilan Betolux:illa maalattu vaaleanharmaa metallinen jalusta, sen voi käyttää esillepanoa varten. Veistos on herkkä, ja se täytyy käsitellä varoen, molemmin käsin vyötäröstä tai tukevasta kohdasta kiinni pitäen. Veistos ja jalusta siirrettävä erikseen.		
OLOSUHDEVAATIMUKSET UV-valosta ja pölystä suojattuna, paikassa missä ilma pääsee vaihtumaan.		
PAKKAAMINEN JA SÄILYTYS UV-valosta ja pölystä suojattuna, muttei suljetussa laatikossa. Sopiva laatikko on esimerkiksi runko, joka on päällystetty Tybek:illa, jotta ilma pääsee vaihtumaan. Käytettävä happovapaita materiaaleja.		

KOKOELMATEOSTEN
DOKUMENTOINTI: VEISTOKSET

ESPOO MUSEUM OF MODERN ART

PERUSTIEDOT

KUVAILU JA RAKENNE
3M Scotch® 550 Transparent teippiä ja polyeteenikelmua sulattamalla valmistettu kirkas ja ontto naishahmo, joka esittää mallinukkea. Hiukset on päällystetty ohueksi leikatulla ruskealla pakkausteipillä, ja hahmon ihon päälle on tehty karvakuviointia samalla teipillä. Hahmon sekä sisälle että ulos on rakennettu rautalangasta, joista ulkona oleva on kiinnitetty veistoksen pintaan vahvistetulla kuittuteipillä. Veistoksen pinta on oletettavasti lakattu Hempel-venelakalla (taiteilija ei ole täysin varma merkistä).

[VAIN EMMALLE]
Valmistustekniikka: Hahmo on valmistettu savesta muovaillun veistoksen päälle, joka on kääritty kahdella kerroksella polyeteenikelmua. Kelmun päälle on laitettu noin 5 kerrosta 3M Scotch® 550 Transparent teippiä. Teippikerrokset on sulatettu yhteen kuumailmapuhaltimella, jonka jälkeen sulatettu kerros on avattu mattoveitsellä, samalla idealla kuin kipsiteokset tehdään. Kuoren osat on laitettu yhteen lisäämällä sitä samaa kirkasta teippiä. Leveimmille kohdille on lisätty sisälle rautalankaa tueksi, ja jalkoihin polymetyylimetakrylaatti (PMMA) -putkia esillepanoa varten. Veistoksen pinnan ulkopuolella olevaa rautalankaa on lisätty silloin kun kuori on vielä ollut savihahmon päällä. Venelakka on lisätty lopussa, yksityiskohtien tekemisen jälkeen.

Teoksen merkitys: ”Haute Couture” sarjassa taiteilija pyrkii esittämään ”tilanteen” muotinäytöksen muodossa, missä hahmot eivät edusta mitään tiettyä henkilöä, vaan ne edustavat ihmisiä tai ihmiskuntaa. Teoksessa ”Turkis” karvoitus tekee hahmosta osittain eläin, jolla taiteilija tutkii ihmisten ja eläinten välistä suhdetta, ja miten ihmisistä voi löytää sisäisen eläimen.

TAUSTATIEDOT
Veistos kuuluu sarjaan “Haute Couture”, mihin kuuluvat myös kaksi muuta teosta: ”Turkis” (SSKO:1972) ja ”Puunsyy” (taiteilijan omistuksessa). Sarja esitettiin Mäntän Kuvataideviikoilla vuonna 2004 (6.6 – 15.8), jonka kuraattorina toimi Kari Kenetti.

PÄIVÄYS	KONSERVAATTORI
3.11.2020	Ane Orue-Etxebarria

KOKOELMATEOSTEN
DOKUMENTOINTI: VEISTOKSET

KUNTO

ESPOO MUSEUM OF MODERN ART

INV.NRO
SSKO:1972

PVM.	YLEISKUNTO	PVM.	YLEISKUNTO
2/2006 11/2019	Tyydyttävää Huono		
PÄIVÄYS JA KONSERVAATTORI	YLEISKUNTO	PVM.	KONSERVOITU (tarkemmat tiedot päiväkirjassa)
22.2.2006 Raili Laakso	Tyydyttävää. - teippien päät ovat osittain koholla, lakattu näin -> kuuluu asiaan - oikean ukkovarpaan kohdalla leveä teippi koholla (noin 1 cm x 3 cm) kulma - vasen sääri on painunut kasaan (merkitty kuvaan) - oikea reisi on painunut kasaan (merkitty kuvaan) - ohuempi putki, vasen jalka, on irti jalkapohjasta		
4.11.2019 Ane Orue-Etxebarria	Huono, todella kellastunut		

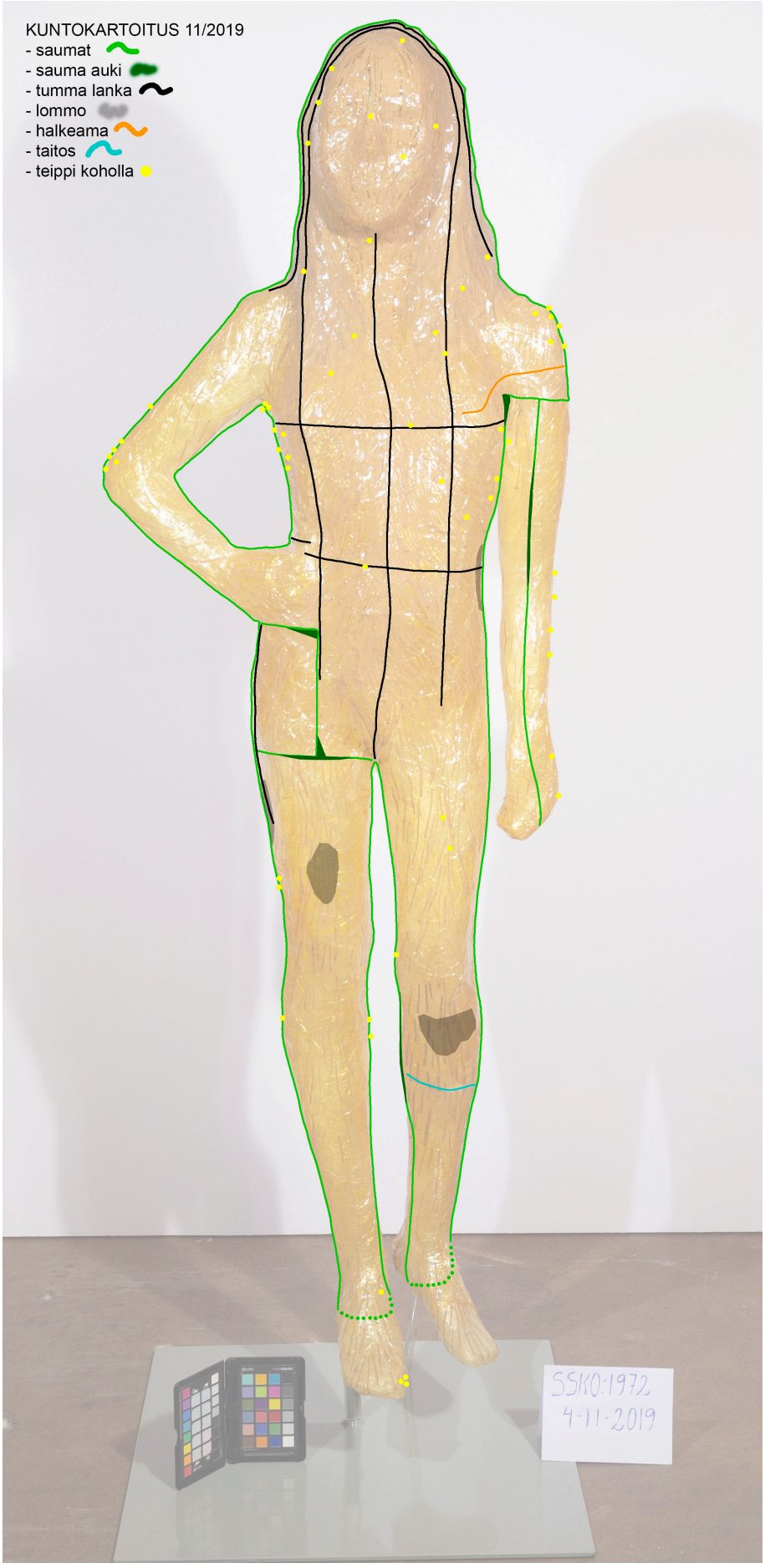
KOKOELMATEOSTEN
DOKUMENTOINTI: VEISTOKSET

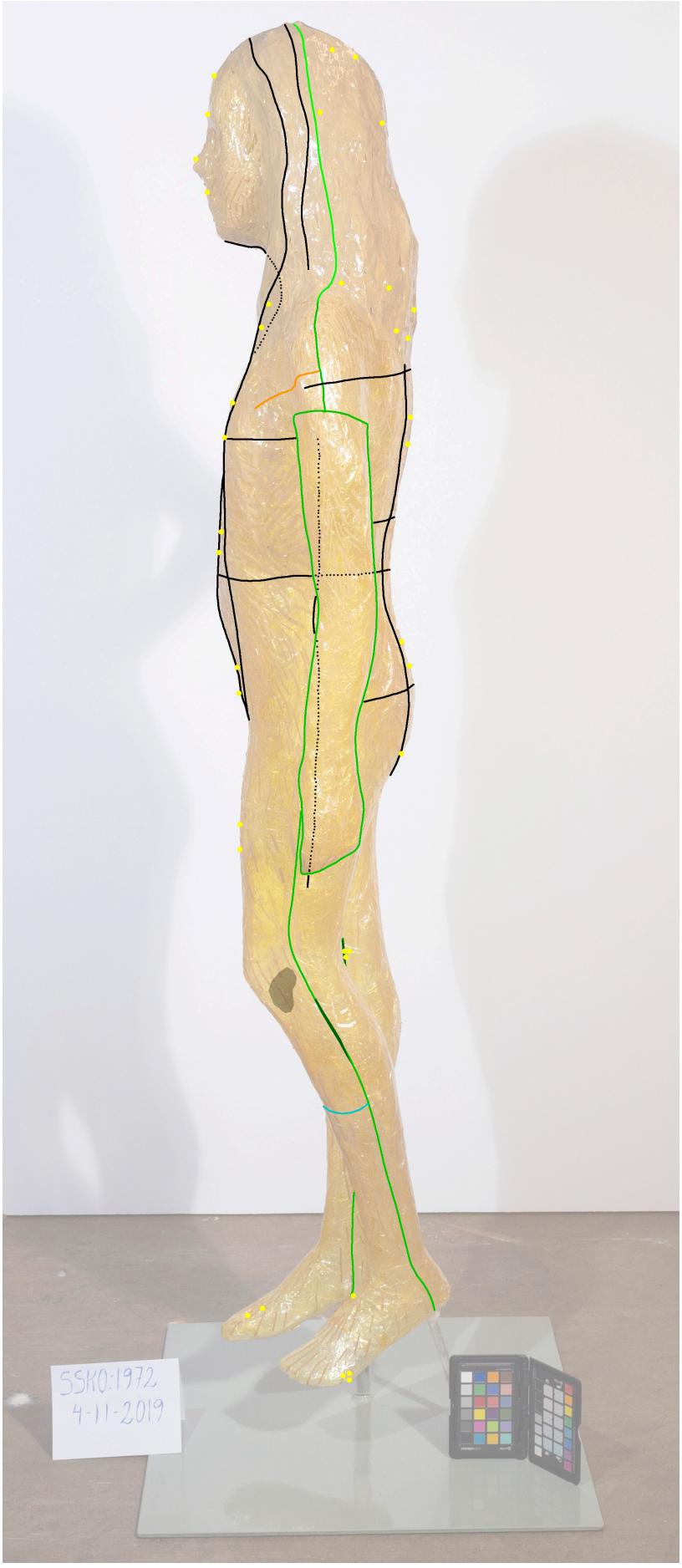
ESPOO MUSEUM OF MODERN ART

PÄIVÄKIRJA

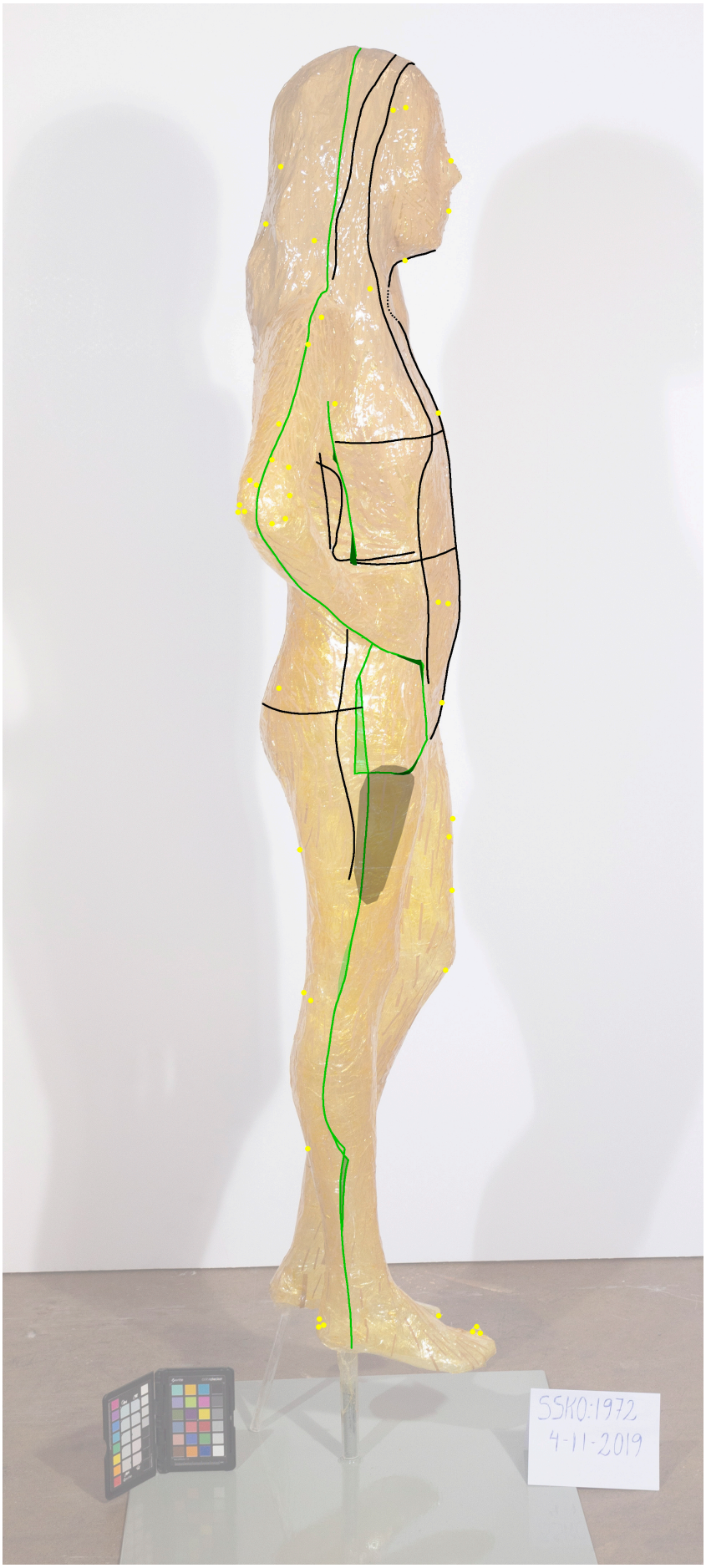
INV. NRO
SSKO:1972

PÄIVÄYS JA KONSERVAATTORI	TOIMENPITEET
22-23.2.2006 Raili Laakso	Dokumentointi, kuntotarkastus ja digikuvaus
4.11.2019-11.3.2020 Ane Orue-Etxebarria	Dokumentointi, kuntotarkastus ja digikuvaus


KUNTOKARTOITUS 11/2019
- saumat
- sauma auki
- tumma lanka
- lommo
- halkeama
- taitos
- teippi koholla
SSKO:1972
4-11-2019


SSKO:1972
4-11-2019


SSKO:1972
4-11-2019


SSKO:1972
4-11-2019

Search results for plastic-containing objects in finna.fi

In order to study the distribution and cataloguing of plastic-containing objects in Finnish museums, a series of searches were conducted in Finna.fi, which is a search engine comprising Finnish archive, library and museum materials. In order to limit the search to museum objects, only the following categories were analyzed: objects, negatives, sculptures, industrial design, art objects, installations, textile art and media art. The results are displayed in Table 1. and Table 2. Search conducted on 31.3.2020 (finna.fi, n.d.).

Table 1. Search results for terms used to catalogue different kinds of plastics. Chemical compound names are written in bold, brand names in italics and common names in plain font.

Material	Nr. of objects per type	Search terms	Nr. of objects per term	Observations
Acrylonitrile butadiene styrene (ABS)	14 objects	**akryylinitriilibutadieenistyreeni**	2 objects	In order to avoid false results for the search term **ABS**, muovi (plastic) was added as a search term.
		ABS (+ muovi)	14 objects	
Casein formaldehyde (CS)	35 objects	kaseiini	32 objects	No results for **kaseiini-formaldehydi**. The actual commercial name is *Galalith*, but the search was conducted using the Finnish common term.
		Galaliitti	3 objects	
Cellulose acetate (CA)	633 negatives 273 objects	**Selluloosa-asetaatti**	625 negatives 151 objects	
		asetaatti	633 negatives 273 objects	
Cellulose nitrate (CN)	14 939 negatives 464 objects 1 media art	**selluloosanitraatti**	1 609 negatives 12 objects	Nitraatti (nitrate) is the name of an inorganic chemical compound that can be present in many other things than cellulose nitrate.
		nitroselluloosa	4 objects	
		nitraatti (+ negatiivi)	14 939 negatives	
		Xylonite	1 object	
		Celluloid	3 objects	
		Selluloidi	448 objects 7 negatives 1 media art	
Glass-reinforced plastic	1 011 objects 21 sculptures 2 installations 2 painting	lujitemuovi	18 objects	
		lasikuitu	1 003 objects 21 sculptures 2 installations 2 paintings	
Gutta percha	221 objects	**guttaperkka**	221 objects	
Melamine formaldehyde (MF)	168 objects 1 painting	melamiini	168 objects 1 painting	No results for **melamiiniformaldehydi**.
		Melaware	1 object	
		Melmex	1 object	
		Melamin	4 objects	
Phenol formaldehyde (PF)	1 100 objects	Fenoli (+ muovi)	40 objects	No results for **fenoli-formaldehydi**. In order to avoid false results for the search term fenoli (phenol), muovi (plastic) was added as a search term.
		Bakelite	5 objects	
		Bakeliitti	1 094 objects	
Polyamide (PA)	1 230 objects 1 installation	**polyamidi**	425 objects	Most of the objects have only been described using one term.
		Nylon	476 objects 1 installation	
		nailon	484 objects	
		Perlon	24 objects	

Polycarbonate (PC)	20 objects 3 paintings 1 installation 1 sculpture	**polykarbonaatti**	20 objects 3 paintings 1 installation 1 sculpture	
Polyester resin	1 092 objects 262 negatives 3 sculptures 2 media art 1 installation 1 painting	**polyesteri**	1 048 objects 262 negatives 3 sculptures 2 media art 1 installation 1 painting	The actual commercial name is *Terylene*, but the search was conducted using the Finnish common term.
		Crimplene	13 objects	
		Dacron	11 objects	
		Teryleeni	32 objects	
		Diolen	8 objects	
Polyehtylene (PE)	321 objects	**polyeteeni**	313 objects	
		polyetyleeni	4 objects	
		Tyvek	4 objects	
Polyethylene terephthalate (PET)	9 objects	**polyeteenitereftalaatti**	9 objects	Polyethene and polyethylene are synonyms.
		polyetyleenitereftalaatti	0	
Poly(methyl methacrylate) (PMMA)	188 objects 14 sculptures 12 paintings 5 art objects 1 installation	**PMMA**	7 objects	No results for **polymetyylimetakrylaatti**. In order to avoid false results for the search term akryyli (acrylic), muovi (plastic) was added as a search term.
		Perspex	1 object	
		Plexiglas	4 sculptures 3 paintings 1 art object	
		pleksi	29 objects 7 sculptures 4 art objects 3 paintings 1 installation	
		akryyli (+ muovi)	158 objects 7 paintings 5 sculptures	
Polypropylene (PP)	69 objects	**polypropeeni**	54 objects	Polypropene and polypropylene and synonyms. Most of the objects have only been described using one term.
		polypropyleeni	15 objects	
		Propathene	1 object	
Polystyrene (PS)	314 objects 1 installation 1 painting 1 art object 1 sculpture	**polystyreeni**	270 objects 1 installation	Most of the objects have only been described using one term.
		styroksi	51 objects 1 painting 1 art object 1 sculpture	
Polyurethane (PUR)	284 objects 1 sculpture	**polyuretaani**	61 objects 1 sculpture	Most of the objects have only been described using one term.
		Lycra	67 objects	
		Spandex	5 objects	
		elastaani (PUR fibre)	155 objects	
Polyvinyl chloride (PVC)	85 objects 1 painting 1 sculpture	**polyvinyylikloridi**	16 objects	The search term vinyyli (vynil) was not used, because plastics other than PVC as also contain the vinyl group
		PVC	80 objects 1 painting 1 sculpture	
Rubber (SB)	6 803 objects 7 art objects 4 installations 3 sculptures 1 media art 1 painting 1 textile art	**Kumi**	6 803 objects 7 art objects 4 installations 3 sculptures 1 media art 1 painting 1 textile art	Objects belonging to the category Vulcanised rubber were subtracted from the totals.
Silicone	30 objects 5 sculptures 4 installations 1 art object	**silikoni**	30 objects 5 sculptures 4 installations 1 art object	
Urea-formaldehyde (UF)	1 object	*Beatl*	1 object	No result searching for **urea-formaldehydi**
Vulcanised rubber (VF)	119 objects 1 art object	**kovakumi**	89 objects 1 art object	The actual commercial name is *Ebonite*, but the search was conducted using the Finnish common term.
		Eboniitti	35 objects	
		Vulcanite	1 object	

Table 2. Search results for the number of objects catalogued in finna.fi as containing plastic. The distribution was studied separately for all the plastic types included in our sample group, for objects, for artworks, and for both combined. Both the number of objects and the percentages were calculated.

Type of plastic	Total number of objects	Percentage	Number of objects and negatives	Percentage	Number of artworks	Percentage
Akryylinitriilibutadieenistyreeni (ABS)	14	0,05 %	14	0,05 %		
Casein formaldehyde (CS)	35	0,12 %	35	0,12 %		
Cellulose acetate (CA)	906	3,04 %	906	3,05 %		
Cellulose nitrate (CN)	15 411	51,72 %	15 410	51,90 %	1	0,93 %
Glass-reinforced plastic	1 036	3,48 %	1 011	4,40 %	25	23,36 %
Gutta percha	221	0,74 %	221	0,74 %		
Melamine formaldehyde (MF)	169	0,57 %	168	0,57 %	1	0,93 %
Phenol formaldehyde (PF)	1 100	3,69 %	1 100	3,70 %		
Polyamide (PA)	1 231	4,13 %	1 230	4,14 %	1	0,93 %
Polycarbonate (PC)	25	0,08 %	20	0,07 %	5	4,67 %
Polyester resin	1 361	4,57 %	1 354	4,56 %	7	6,54 %
Polyethylene (PE)	321	1,08 %	321	1,08 %		
Polyethylene terephthalate (PET)	9	0,03 %	9	0,03 %		
Poly(methyl methacrylate) (PMMA)	220	0,74 %	188	0,63 %	32	29,91 %
Polypropylene (PP)	69	0,23 %	69	0,23 %		
Polystyrene (PS)	318	1,07 %	314	1,06 %	4	3,74 %
Polyurethane (PUR)	285	0,96 %	284	0,96 %	1	0,93 %
Polyvinyl chloride (PVC)	87	0,29 %	85	0,29 %	2	1,87 %
Rubber (SB)	6 820	22,89 %	6 803	22,91 %	17	15,89 %
Silicone	40	0,13 %	30	0,10 %	10	9,35 %
Urea-formaldehyde	1	0,003 %	1	0,003 %		
Vulcanised rubber (VF)	120	0,40 %	119	0,40 %	1	0,93 %

Product information sheets (extracts)

Betolux urethane alkyd paint

Täyttää asetuksen (EY) nro 1907/2006 (REACH) liitteen II vaatimukset asetuksen (EU) nro 2015/830 mukaisesti muutettuna - Suomi

Julkaisupäivä/ Tarkistuspäivä : 6/17/2019 **Edellinen päiväys** : 3/17/2017

KÄYTTÖTURVALLISUUSTIEDOTE

BETOLUX

KOHTA 1: Aineen tai seoksen ja yhtiön tai yrityksen tunnistetiedot

1.1 Tuotetunniste

Tuotenimi : BETOLUX

Tuotteen kuvaus : Uretaanialkydimaali

1.2 Aineen tai seoksen merkitykselliset tunnistetut käytöt ja käytöt, joita ei suositella

Käyttötarkoitus: Maalaustyö

1.3 Käyttöturvallisuustiedotteen toimittajan tiedot

Valmistaja tai Jälleenmyyjä

Tikkurila Oyj
PL 53
01301 VANTAA
Puhelin 020 191 2000

Tämän KTT:n vastuuhenkilön sähköpostiosoite : Tikkurila Oyj,
Tuoteturvapalvelu,
e-mail: productsafety@tikkurila.com

1.4 Hätäpuhelinnumero

Puhelinnumero : 112
(24h)

Kansallinen neuvontaelin/Myrkytystietokeskus

Puhelinnumero : 0800 147 111
09 471 977
(24h)

Toimittaja tai Valmistaja

Puhelinnumero : Tikkurila Oyj
+358 20 191 2000 (GMT +2) Ma-Pe 8-16

KOHTA 3: Koostumus ja tiedot aineosista

3.2 Seokset : Seos

Tuotteen/ainesosan nimi	Tunnisteet	%	Luokitus Asetus (EY) nro 1272/2008 [CLP]	Huomautukset
hiilivedyt, C9-C11, n-alkaanit, isoalkaanit, sykliset, <2% aromaatteja	REACH #: 01-2119463258-33 ES: 919-857-5 CAS: -	≥25 - ≤50	Flam. Liq. 3, H226 STOT SE 3, H336 Asp. Tox. 1, H304 EUH066	H,P
hiilivetyjä, C10-C13, n-alkaanit, isoalkaanit, sykliset, < 2% aromaatteja	REACH #: 01-2119457273-39 ES: 918-481-9	≤3	Asp. Tox. 1, H304 EUH066	-
2-etyyliheksaanihappo, zirkoniumsuola	REACH #: 01-2119979088-21 ES: 245-018-1 CAS: 22464-99-9	≤1	Repr. 2, H361d (Syntymätön lapsi)	-
etyylimetyyliketoksiimi	REACH #: 01-2119539477-28 ES: 202-496-6 CAS: 96-29-7 Indeksi: 616-014-00-0	≤0.3	Acute Tox. 4, H312 Eye Dam. 1, H318 Skin Sens. 1, H317 Carc. 2, H351 **Katso kohdasta 16 H-lausekkeiden täydelliset tekstit.**	-

Ei sisällä lisäaineita, jotka tavarantoimittajan tämänhetkisen tietämyksen mukaan ja soveltuvina pitoisuuksina luokitellaan terveydelle tai ympäristölle vaarallisiksi tai joille on määritetty työperäinen altistumisen raja-arvo tai PBT tai vPvB ja joista tämän vuoksi pitäisi tässä osiossa ilmoittaa.

Haitalliseksi tunnetut pitoisuudet, mikäli saatavilla, on lueteltu kohdassa 8.

Aineita koskevat huomautukset, katso asetus (EY) N:o 1272/2008, Liite VI.

Empire alkyd paint

Täyttää asetuksen (EY) nro 1907/2006 (REACH) liitteen II vaatimukset asetuksen (EU) nro 2015/830 mukaisesti muutettuna - Suomi

Julkaisupäivä/ Tarkistuspäivä : 6/18/2019 **Edellinen päiväys** : 3/14/2017

KÄYTTÖTURVALLISUUSTIEDOTE

EMPIRE

KOHTA 1: Aineen tai seoksen ja yhtiön tai yrityksen tunnistetiedot

1.1 Tuotetunniste

Tuotenimi : EMPIRE

Tuotteen kuvaus : Alkydimaali.

1.2 Aineen tai seoksen merkitykselliset tunnistetut käytöt ja käytöt, joita ei suositella

Käyttötarkoitus: Maalaustyö

1.3 Käyttöturvallisuustiedotteen toimittajan tiedot

Valmistaja tai Jälleenmyyjä

Tikkurila Oyj
PL 53
01301 VANTAA
Puhelin 020 191 2000

Tämän KTT:n vastuuhenkilön sähköpostiosoite : Tikkurila Oyj,
Tuoteturvapalvelu,
e-mail: productsafety@tikkurila.com

1.4 Hätäpuhelinnumero

Puhelinnumero : 112
(24h)

Kansallinen neuvontaelin/Myrkytystietokeskus

Puhelinnumero : 0800 147 111
09 471 977
(24h)

Toimittaja tai Valmistaja

Puhelinnumero : Tikkurila Oyj
+358 20 191 2000 (GMT +2) Ma-Pe 8-16

KOHTA 3: Koostumus ja tiedot aineosista

3.2 Seokset : Seos

Tuotteen/ainesosan nimi	Tunnisteet	%	Luokitus Asetus (EY) nro 1272/2008 [CLP]	Huomautukset
Hiilivedyt, C9-C11, n-alkaanit, isoalkaanit, sykliset, <2% aromaatteja	REACH #: 01-2119463258-33 ES: 919-857-5 CAS: -	≥25 - ≤50	Flam. Liq. 3, H226 STOT SE 3, H336 Asp. Tox. 1, H304 EUH066	H,P
2-etyyliheksaanihappo, zirkoniumsuola	REACH #: 01-2119979088-21 ES: 245-018-1 CAS: 22464-99-9	≤0.3	Repr. 2, H361d (Syntymätön lapsi)	-
etyylimetyyliketoksiimi	REACH #: 01-2119539477-28 ES: 202-496-6 CAS: 96-29-7 Indeksi: 616-014-00-0	≤0.3	Acute Tox. 4, H312 Eye Dam. 1, H318 Skin Sens. 1, H317 Carc. 2, H351 **Katso kohdasta 16 H-lausekkeiden täydelliset tekstit.**	-

Ei sisällä lisäaineita, jotka tavarantoimittajan tämänhetkisen tietämyksen mukaan ja soveltuvina pitoisuuksina luokitellaan terveydelle tai ympäristölle vaarallisiksi tai joille on määritetty työperäinen altistumisen raja-arvo tai PBT tai vPvB ja joista tämän vuoksi pitäisi tässä osiossa ilmoittaa.

Haitalliseksi tunnetut pitoisuudet, mikäli saatavilla, on lueteltu kohdassa 8.

Aineita koskevat huomautukset, katso asetus (EY) N:o 1272/2008, Liite VI.

Unica Super 20 urethane alkyd varnish

Täyttää asetuksen (EY) nro 1907/2006 (REACH) liitteen II vaatimukset asetuksen (EU) nro 2015/830 mukaisesti muutettuna - Suomi

Julkaisupäivä/ Tarkistuspäivä : 6/29/2018 **Edellinen päiväys** : 3/29/2017

KÄYTTÖTURVALLISUUSTIEDOTE

UNICA SUPER 20

KOHTA 1: Aineen tai seoksen ja yhtiön tai yrityksen tunnistetiedot

1.1 Tuotetunniste

Tuotenimi : UNICA SUPER 20

Tuotteen kuvaus : Uretaanialkydilakka.

1.2 Aineen tai seoksen merkitykselliset tunnistetut käytöt ja käytöt, joita ei suositella

Käyttötarkoitus: Maalaustyö

1.3 Käyttöturvallisuustiedotteen toimittajan tiedot

Valmistaja tai Jälleenmyyjä

Tikkurila Oyj
PL 53
01301 VANTAA
Puhelin 020 191 2000

Tämän KTT:n vastuuhenkilön sähköpostiosoite : Tikkurila Oyj,
Tuoteturvapalvelu,
e-mail: productsafety@tikkurila.com

1.4 Hätäpuhelinnumero

Puhelinnumero : 112
(24h)

Kansallinen neuvontaelin/Myrkytystietokeskus

Puhelinnumero : +358 (0)9 471977
(24h)

Toimittaja tai Valmistaja

Puhelinnumero : Tikkurila Oyj
+358 20 191 2000 (GMT +2) Ma-Pe 8-16

KOHTA 3: Koostumus ja tiedot aineosista

3.2 Seokset : Seos

Tuotteen/ainesosan nimi	Tunnisteet	%	Luokitus Asetus (EY) nro 1272/2008 [CLP]	Huomautukset
hiilivedyt, C9-C11, n-alkaanit, isoalkaanit, sykliset, <2% aromaatteja	REACH #: 01-2119463258-33 ES: 919-857-5 CAS: -	≥25 - ≤50	Flam. Liq. 3, H226 STOT SE 3, H336 Asp. Tox. 1, H304 EUH066	H,P
hiilivedyt, C9, aromaattiset	REACH #: 01-2119455851-35 ES: 918-668-5 CAS: -	≤10	Flam. Liq. 3, H226 STOT SE 3, H335 STOT SE 3, H336 Asp. Tox. 1, H304 Aquatic Chronic 2, H411 EUH066	H,P
1-metoksi-2-propanoli	REACH #: 01-2119457435-35 ES: 203-539-1 CAS: 107-98-2 Indeksi: 603-064-00-3	≤3	Flam. Liq. 3, H226 STOT SE 3, H336	-
etyylimetyyliketoksiimi	REACH #: 01-2119539477-28 ES: 202-496-6 CAS: 96-29-7 Indeksi: 616-014-00-0	<1	Acute Tox. 4, H312 Eye Dam. 1, H318 Skin Sens. 1, H317 Carc. 2, H351 **Katso kohdasta 16 H-lausekkeiden täydelliset tekstit.**	-

Ei sisällä lisäaineita, jotka tavarantoimittajan tämänhetkisen tietämyksen mukaan ja soveltuvina pitoisuuksina luokitellaan terveydelle tai ympäristölle vaarallisiksi tai joille on määritetty työperäinen altistumisen raja-arvo tai PBT tai vPvB ja joista tämän vuoksi pitäisi tässä osiossa ilmoittaa.

Haitalliseksi tunnetut pitoisuudet, mikäli saatavilla, on lueteltu kohdassa 8.

Aineita koskevat huomautukset, katso asetus (EY) N:o 1272/2008, Liite VI.

VIS-spectrophotometry readings on mockup samples during artificial aging

Results of the VIS-spectrophotometry readings of the mockup test samples during the artificial aging in different environments. The measurements were performed on the starting day, as well as after a period of 24 hours, 48 hours, 72 hours, 1 week, 2 weeks, 3 weeks and 1 month. The data for the first day was measured from only one sample, since samples were taken from the same starting material. In consecutive measurements, one test sample per environment was analyzed, since the samples did not show any differences in plain sight. Five measurements were taken of each sample, and values for L, a and b written down, as well as standard deviation values. The results can be found in Tables 1 – 6. below.

Table 1. VIS-spectrophotometry results for Environment 1: outside the oven (reference sample).

Env. 1	L (mean)	L (S.D.)	a (mean)	a (S.D.)	b (mean)	b (S.D.)
0 hours	92,08	0,1577	-1,10	0,0092	6,28	0,0143
24 hours	90,68	0,1320	-1,08	0,0041	6,36	0,1032
48 hours	90,71	0,7332	-1,06	0,0349	6,03	0,1455
72 hours	90,86	0,3222	-1,08	0,0082	6,36	0,0760
1 week	90,98	0,2284	-1,07	0,0125	6,28	0,0774
2 weeks	90,93	0,1257	-1,04	0,0063	6,23	0,0513
3 weeks	90,98	0,3117	-1,06	0,0068	6,19	0,0628
1 month	91,22	0,2048	-1,05	0,0131	6,12	0,0366

Table 2. VIS-spectrophotometry results for Environment 2: in the oven, where air changes 3 – 10 times per hour.

Env. 2	L (mean)	L (S.D.)	a (mean)	a (S.D.)	b (mean)	b (S.D.)
0 hours	92,08	0,1577	-1,10	0,0092	6,28	0,0143
24 hours	90,99	0,3786	-1,07	0,0130	6,00	0,1027
48 hours	90,69	0,5441	-1,07	0,0064	6,00	0,0702
72 hours	92,14	0,5119	-1,18	0,0124	6,89	0,0926
1 week	92,59	0,1648	-1,26	0,0216	7,24	0,0324
2 weeks	90,69	0,3313	-1,24	0,0403	6,88	0,1791
3 weeks	90,48	0,3780	-1,23	0,0419	6,83	0,1580
1 month	92,03	0,1784	-1,42	0,0330	8,13	0,1107

Table 3. VIS-spectrophotometry results for Environment 3: in the oven, inside an airtight container.

Env. 3	L (mean)	L (S.D.)	a (mean)	a (S.D.)	b (mean)	b (S.D.)
0 hours	92,08	0,1577	-1,10	0,0092	6,28	0,0143
24 hours	91,24	0,4148	-1,13	0,0523	6,33	0,1386
48 hours	91,19	0,2558	-1,12	0,0086	6,35	0,0224
72 hours	90,49	0,1632	-1,16	0,0123	6,64	0,0455
1 week	90,49	0,2306	-1,26	0,0173	7,20	0,0882
2 weeks	90,33	0,5179	-1,33	0,0431	7,77	0,1302
3 weeks	90,41	0,3523	-1,43	0,0283	8,16	0,1725
1 month	89,90	0,2617	-1,40	0,0139	8,25	0,0686

Table 4. VIS-spectrophotometry results for Environment 4: in the oven, inside an airtight container, with a 10 x 10 mm^2 piece of the same kind of cardboard used to store the sculptures.

Env. 4	L (mean)	L (S.D.)	a (mean)	a (S.D.)	b (mean)	b (S.D.)
0 hours	92,08	0,1577	-1,10	0,0092	6,28	0,0143
24 hours	91,71	0,6055	-1,12	0,0429	6,30	0,1777
48 hours	90,88	0,1778	-1,32	0,0133	7,37	0,0309
72 hours	91,00	0,4446	-1,35	0,0109	7,60	0,0516
1 week	90,89	0,4511	-1,49	0,0157	8,30	0,0480
2 weeks	90,83	0,5305	-1,58	0,0230	8,98	0,0753
3 weeks	90,64	0,4889	-1,64	0,0098	9,51	0,0524
1 month	90,77	0,4246	-1,71	0,0127	9,83	0,1120

Table 5. VIS-spectrophotometry results for Environment 5: in the oven, inside an airtight container, with 10 g of Tikkurila's Empire alkyd paint (Appendix 5.).

Env. 5	L (mean)	L (S.D.)	a (mean)	a (S.D.)	b (mean)	b (S.D.)
0 hours	92,08	0,1577	-1,10	0,0092	6,28	0,0143
24 hours	90,47	0,2320	-0,99	0,0168	6,33	0,0544
48 hours	90,07	0,3053	-1,12	0,0197	7,72	0,0784
72 hours	90,30	0,2591	-1,24	0,0236	8,02	0,0915
1 week	89,35	0,6345	-1,25	0,0307	9,93	0,0449
2 weeks	89,51	0,4168	-1,12	0,0183	9,93	0,0588
3 weeks	89,48	0,3558	-1,12	0,0227	10,36	0,0945
1 month	88,81	0,0855	-1,14	0,0332	10,75	0,1003

Table 6. VIS-spectrophotometry results for Environment 6: in the oven, inside an airtight container, with a 10 x 10 mm^2 piece of the same kind of cardboard used to store the sculptures and 10 g of Tikkurila's Empire alkyd paint (Appendix 5.).

Env. 6	L (mean)	L (S.D.)	a (mean)	a (S.D.)	b (mean)	b (S.D.)
0 hours	92,08	0,1577	-1,10	0,0092	6,28	0,0143
24 hours	91,61	0,2313	-0,95	0,0150	6,69	0,1422
48 hours	91,46	0,1510	-0,99	0,0317	7,10	0,2178
72 hours	91,57	0,2288	-1,05	0,0112	7,04	0,0781
1 week	90,07	0,6044	-1,18	0,0545	8,81	0,3453
2 weeks	90,52	0,4261	-1,14	0,0205	9,57	0,1531
3 weeks	90,40	0,4736	-1,28	0,1031	10,71	0,5063
1 month	90,04	0,3837	-1,35	0,8334	11,42	0,2334

FTIR spectra of mockup samples after artificial aging

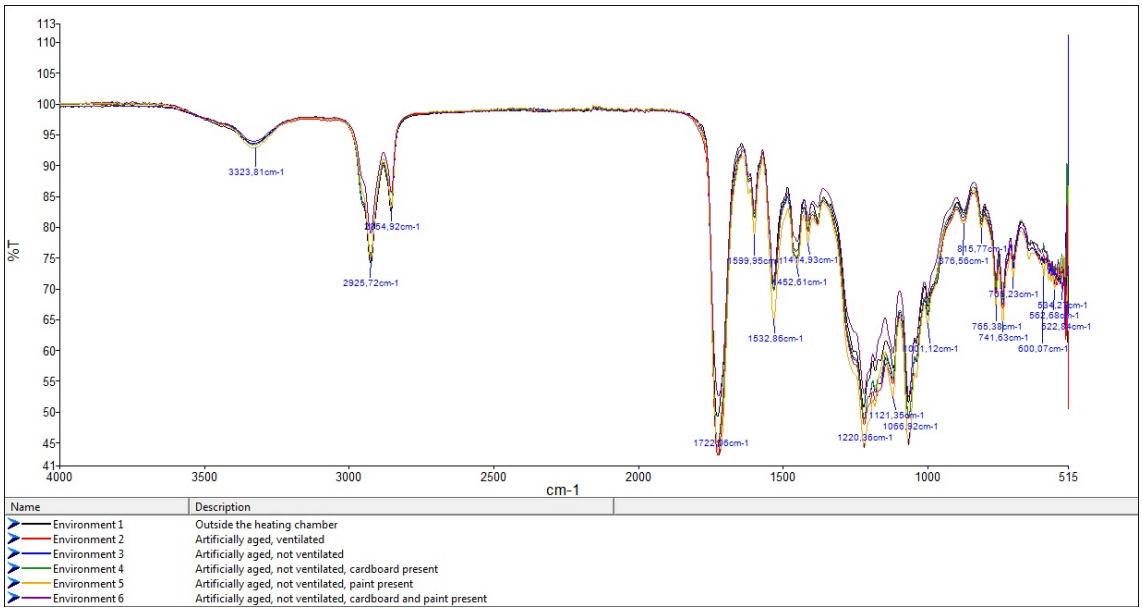


Figure 35. FTIR spectra of mockup test samples after artificial testing

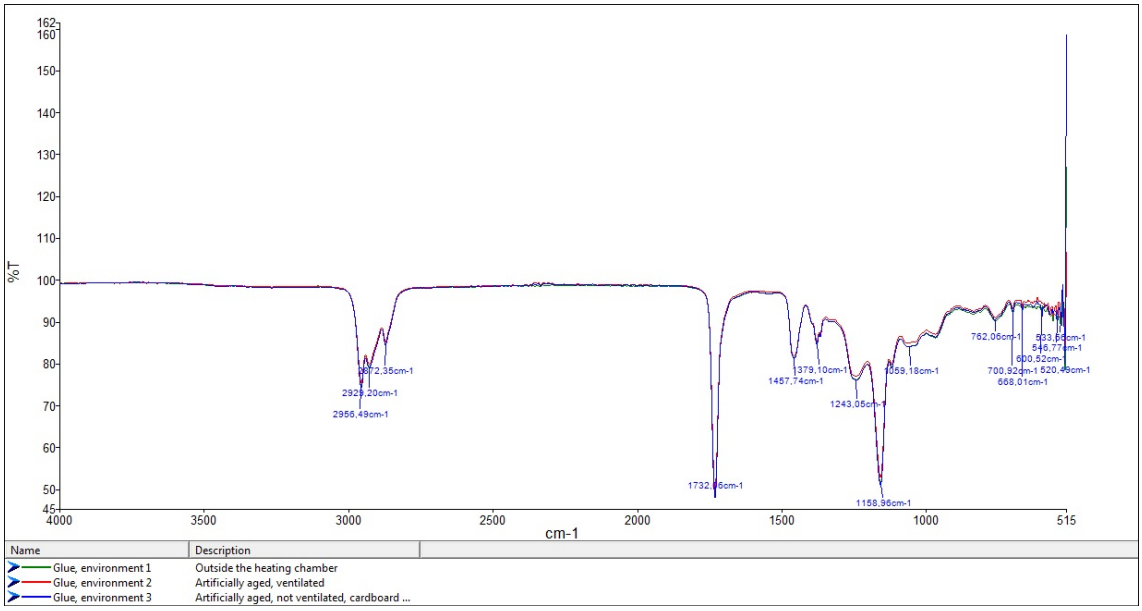


Figure 36. FTIR spectra of glue samples after artificial testing